McKinsey Global Institute

July 2014

# China's digital transformation: The Internet's impact on productivity and growth

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# China's digital transformation: The Internet's impact on productivity and growth

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# Preface

Some 18 months ago, the McKinsey Global Institute published a report on the explosive growth of e-tailing in China, noting that the Internet was producing real macroeconomic effects by spurring incremental consumption. Today China's consumer-focused Internet is transforming into a more business-oriented Internet. This next wave of digital development promises to have an even deeper impact on China's economy—contributing not only to faster GDP growth but to growth that is based on productivity, innovation, and consumption.

This research examines six representative sectors of China's economy and analyzes the transformations that are taking place within them as new Internet applications take hold. It finds that these innovations will not only generate productivity gains but also lead to the creation of entirely new markets for digital goods and services. Beyond the effects within these sectors, the Internet creates information transparency that can improve investment decisions and make the allocation of capital more efficient throughout the entire economy. As business adoption of the Internet reaches critical mass, competition will intensify for companies and workers alike. Major industries may be entering a period of disruptive change, but China's digital transformation could lead to productivity growth and rapid innovation. Even more important, it could produce societal benefits that include wider access to capital, a more effective health-care system, and a workforce with greater skills.

This project was led by MGI senior fellows Elsie Chang and Jeongmin Seong, along with MGI director Jonathan Woetzel; McKinsey & Company directors Gordon Orr and Alan Lau; and MGI principals Yougang Chen and Michael Chui. The project team was managed by Autumn Qiu and consisted of Ellen Chang, Welson Li, Nancy Nan, Candy Tang, Betty Yee, and Sellina Yu. Thanks to Lisa Renaud and Lin Lin for editorial support and to our communications, operations, and production colleagues—including Marisa Carder, Fanny Chan, Deadra Henderson, Bo Jiang, Glenn Leibowitz, Julie Philpot, Rebeca Robboy, and Rebecca Zhang—for their much appreciated contributions.

A number of colleagues made significant contributions to our fact base, including MGI director James Manyika, MGI principal Jaana Remes, and MGI senior fellow Jan Mischke. We also extend thanks to our research colleagues Tim Beacom, Ningkun Hu, Shumi Jain, Karen P. Jones, Xiujun Lillian Li, Hongying Liao, Terry Sun, Yang Wang, Jing Xiao, Frances Xu, Lei Xu, Tony Zhou, and Xin Zhou.

This report benefited greatly from the support and expertise provided by numerous McKinsey colleagues across the globe and from a range of industry practices. We are grateful to Markus Allesch, Nick Arnold, Wouter Baan, Diego Barillà, Dirk Breitschwerdt, Philip Bruno, Jacques Bughin, Elizabeth Bury, Jamie Cattell, Amy Chen, Jason Chen, Joe Chen, Mei-Jung Chen, Rae Chen, Jayson Chi, Violet Chung, Costanza Citrini, Joseph Cyriac, Julian Dai, Olivier Denecker, Fey Deng, Karel Eloot, Mauro Erriquez, Dan Ewing, Xiyuan Fang, Maxine Fu, Stefan Fürnsinn, K Ganesh, Paul Gao, Bill Gerhardt, Fang Gong,

Geliang Gong, Peter Groves, Mingyu Guan, Andreas Habeck, Dörte Hahn, Joseph He, David Henderson, Sheng Hong, Eddie Huang, Daniel Hui, Sheinal Jayantilal, David Jiang, Sebastian Kempf, Thilo-Anyas König, Jan-Christoph Köstring, Axel Krieger, Kenny Lam, Joshua Lan, Franck Le Deu, Dan Leberman, Martin Lehnich, Nicolas Leung, Guangyu Li, Vincent Li, Yinuo Li, Wenkan Liao, Marc Lien, Nathan Liu, Li Ma, Lars Markworth, Dmitri Mishustin, Timo Möller, Alexander Ng, Tunde Olanrewaju, Gregory Otte, Michael Phillips, Philipp Radtke, Gérard Richter, Dave Rogers, Robert Schiff, Sha Sha, Kai Shen, Philipp Siebelt, Ari Silverman, Sebastian Sjöberg, Kevin Sneader, Min Su, Florian Then, Christopher Thomas, Kevin Wei Wang, Larry Wang, Dominik Wee, Florian Weig, Jun Xu, Max Yang, Peter Zarth, Haimeng Zhang, and Daniel Zipser.

We are also grateful for the challenge and advice provided by our academic advisers for this research: Martin Baily, the Bernard L. Schwartz Chair in Economic Policy Development at the Brookings Institution; and Xinmin Gao, vice president of the Internet Society of China.

In the course of the project, we interviewed more than 50 regional experts and business leaders to understand the emerging Internet in China and around the world. We extend our thanks for their time and insight.

This independent MGI initiative drew on data and expertise from the Alibaba Group Research Center and Baidu Development Research Center. Part of our analysis was made possible through this collaboration, and we are grateful for their assistance. As with all MGI research, however, this work is fully funded by the partners of McKinsey & Company and has not been commissioned or sponsored in any way by any business, government, or other institution.

This report furthers MGI's mission to understand the forces transforming the global economy, identify strategic opportunities, and prepare for the next wave of growth. We welcome your comments on the research at MGI@mckinsey.com.

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July 2014

# *From a consumer-oriented Internet …*

**632 million**
Chinese Internet users in 2014

**700 million**
Active smart devices

**~US$300 billion**
2013 e-tailing sales

**4.4%**
Size of China's Internet economy as a share of 2013 GDP—higher than the United States or Germany

# *... to a more enterprise-driven Internet*

**7–22%**
The Internet's contribution to the total GDP increase expected through 2025

**Up to 22%**
The Internet's contribution to China's productivity growth by 2025

**RMB 610 billion**
Potential annual savings in health-care expenditures by 2025

**RMB 10 trillion**
Annual GDP at stake by 2025, equivalent in size to Australia's current GDP

主题餐厅

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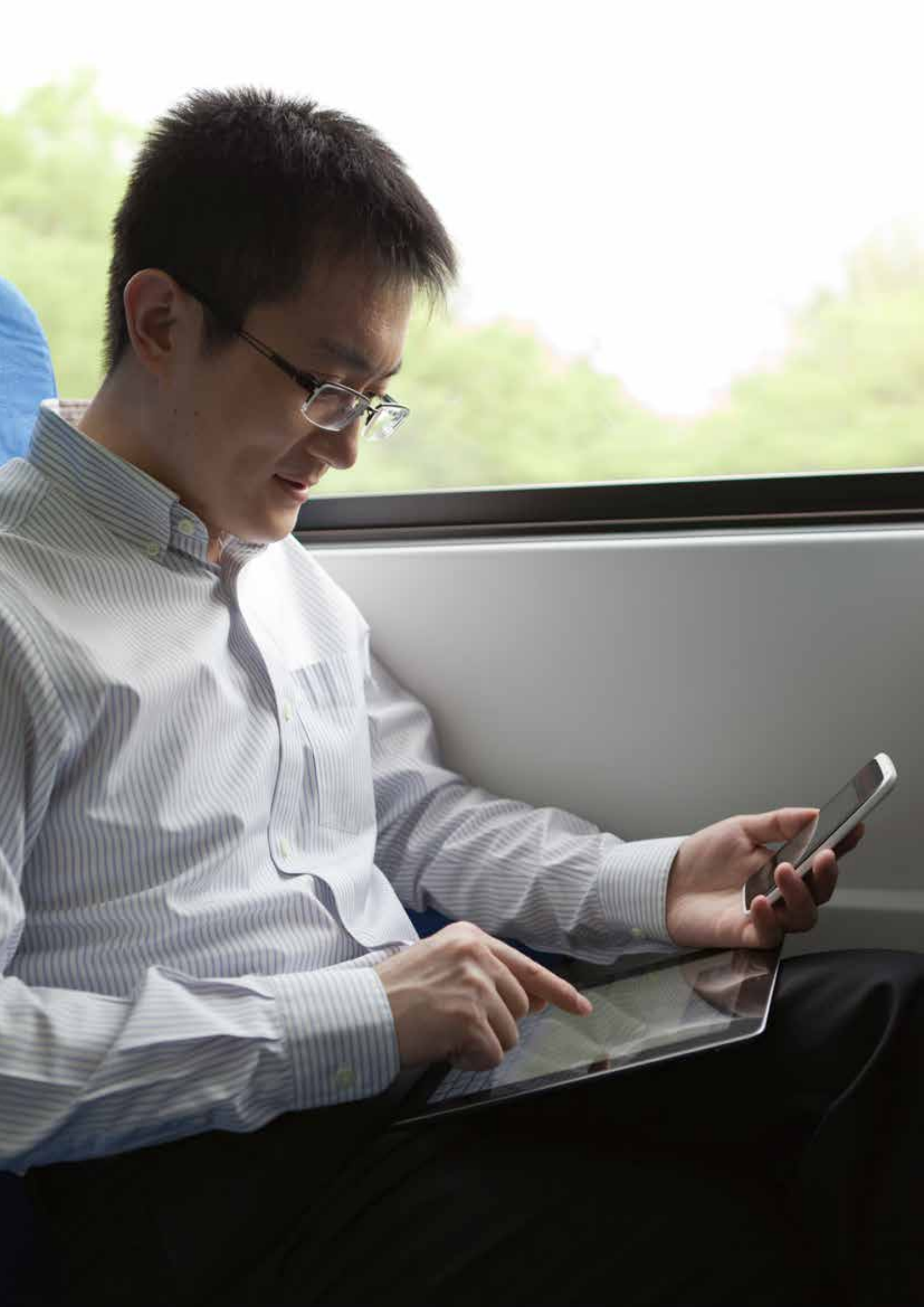


# Executive summary

China is in the midst of a digital revolution. During the course of 2013, the number of active smart devices grew from 380 million to 700 million.[1] On Singles Day, the e-commerce marketplaces Taobao and Tmall posted more than RMB 36 billion (almost $6 billion) in sales in just 24 hours. Some five billion daily searches are made through Baidu, and hundreds of millions communicate via WeChat, Tencent's mobile messaging app. Now with 632 million users—and counting—the Internet is fundamentally altering the fabric of daily life in China.[2]

Until now, China's Internet has been largely consumer-focused (Exhibit E1). But that is about to change as the Internet penetrates more deeply across major sectors of the economy. As companies embrace Web technologies, their operations become more efficient, translating into productivity gains. While this process is likely to displace some workers from existing roles, the Internet also creates new markets for innovative products and services, increasing demand for workers with digital skills.

**Exhibit E1**

**China's Internet has been consumer-driven rather than enterprise-driven**

**2013**

| | | China | United States |
|---|---|---|---|
| Consumer side | **Internet usage** | | |
| | ▪ Users | 632 million[2] | 277 million |
| | ▪ Penetration | 46% | 87% |
| | **E-tailing** | | |
| | ▪ Size | $295 billion | $270 billion |
| | ▪ Share of retail | 7–8% | 6% |
| | **E-commerce platforms** | Taobao/Tmall | eBay |
| | ▪ Items | 800 million | 550 million |
| | ▪ Active buyers | 231 million | 128 million |
| | **Smartphone penetration (share of installed base)** | 54% | 69% |
| | **Social networking among Internet users** | 60% | 73% |
| Enterprise side | **Enterprise cloud adoption rate** | 21%[3] | 55–63%[4] |
| | **SMEs Internet adoption ratio**[1] | 20–25% | 72–85% |

1 Positive survey responses for Internet use in procurement, sales, and marketing.
2 As of July 2014.
3 McKinsey China CIO survey, 2012.
4 Rates vary depending on types of cloud computing solutions.

SOURCE: Kable ICT Customer Insight survey, 2013; National Small Business Association survey, 2013; iResearch; China Internet Network Information Center; International Data Corporation; Strategy Analytics; US Census Bureau; Pew Research Center; National Small Business Association; McKinsey Global Institute analysis

1 *China mobile Internet 2013 overview*, Umeng Insight Report, March 2014.

2 China Internet Network Information Center, July 2014.

Depending on the speed and extent of industry adoption, the Internet could add 0.3 to 1.0 percentage points to China's GDP growth rate from 2013 to 2025. This could fuel some 7 to 22 percent of the incremental GDP growth expected through 2025—and by that point, it could translate into RMB 4 trillion to 14 trillion in annual GDP.

The Internet will not only be a source of much-needed momentum for China in the years ahead; it will also change the very nature of growth. The heavy capital investment and labor force expansion that fueled China's rise over the past two decades cannot be sustained indefinitely. The Internet, by contrast, can enable GDP growth that is based on productivity, innovation, and consumption. It also intensifies competition, allowing the most efficient enterprises to win out more quickly, and creates information transparency that improves investment decisions so that capital can be better allocated. It can spur skill upgrades within the workforce and create consumer surplus by lowering prices, making information more widely available, and enabling a multitude of new conveniences. The economy's shift toward the Internet will entail some risks and disruptions, but it can ultimately support China's goal of creating a more sustainable model for economic growth.

## China is on the brink of a digital transformation that will enhance productivity and spur economic growth

The Internet provides a platform for millions of daily online transactions and communications that make a significant contribution to individual economies. MGI has developed the iGDP indicator to measure the size of a country's "Internet economy."[3] In 2010, China's Internet economy stood at 3.3 percent of its GDP, lagging behind most advanced economies. By 2013, its iGDP had reached 4.4 percent, moving China into the ranks of the global leaders (Exhibit E2).

China's Internet has already given rise to a dynamic technology sector, thriving social networks, and the world's largest e-tailing market. But the Web is just beginning to penetrate many Chinese businesses—and the most sweeping changes are yet to come. According to McKinsey's latest survey of CIOs, the typical Chinese company spends 2 percent of revenue on IT, far below the 4 percent international average, but respondents predict significant increases by 2015, indicating clear momentum.[4]

This report focuses on major new uses of the Internet that could penetrate more deeply in six sectors that collectively accounted for approximately one-quarter of Chinese GDP in 2013. Assuming that the Internet has a comparable impact on the rest of the economy, we project that these applications, combined with the finance sector's new capabilities to allocate capital more effectively, could enable 7 to 22 percent of the total increase in China's GDP projected from 2013 to 2025.[5]

---

3 The iGDP indicator uses the expenditure method of calculating GDP. It totals all activities linked to the creation and use of Internet networks and services: consumption by individuals (including hardware, software, Internet access, and e-commerce), public expenditure (including infrastructure), business investment in Internet technologies, and the country's trade balance in Internet-related goods and services.

4 Dominic Barton, "Seizing China's new digital opportunity," *McKinsey on Business Technology*, number 29, spring 2013.

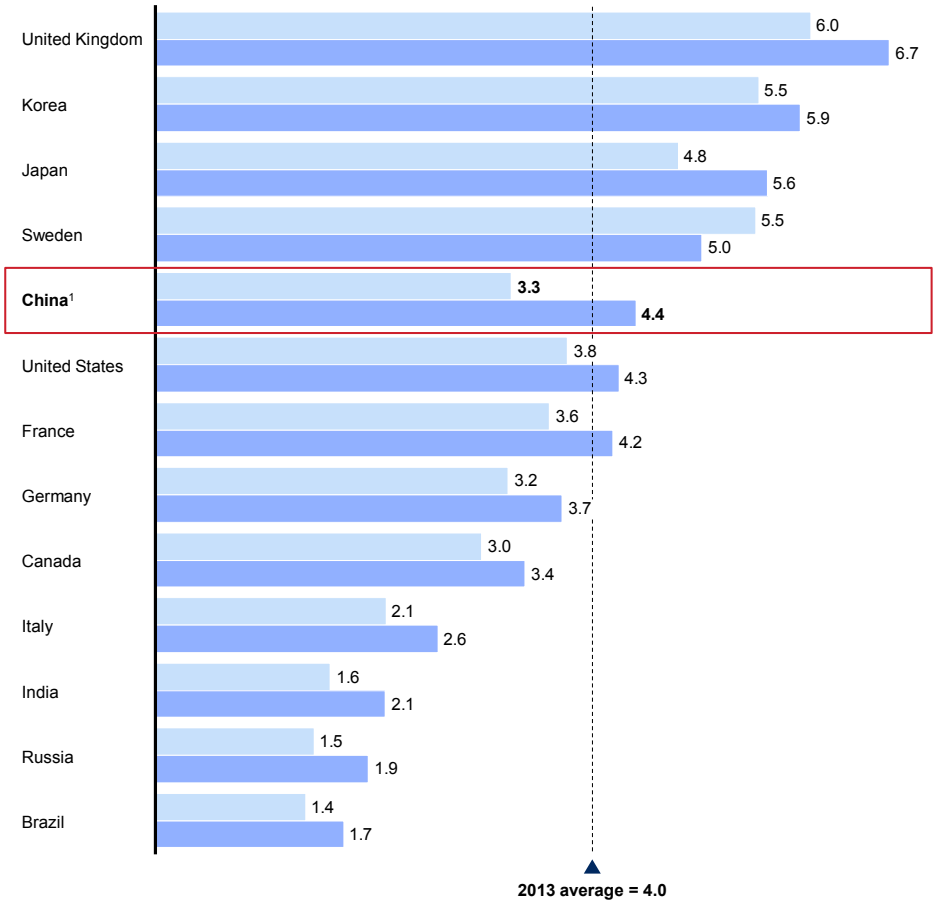
5 2025 GDP projections from IHS.

**Exhibit E2**

**China's Internet economy is already larger than those of the United States, France, and Germany as a share of GDP**

**iGDP, 2013**

Internet-related expenditures as % of respective country GDP




1 The C2C (consumer-to-consumer) e-tailing category in most countries primarily consists of secondary-market transactions by individuals and is negligible. But in China, it encompasses sales by small enterprises and microbusinesses without company registration. If C2C is included, China's iGDP would be 7 percent, higher than that of any G7 country.

SOURCE: McKinsey Global Institute analysis

The low end of these projections represents the current trajectory of adoption of these applications—that is, trends that are already unfolding today continue to take hold but existing constraints remain in place. The upper end assumes that a supportive policy framework is put in place quickly and that industries move aggressively to integrate these new Internet applications and build these new markets for digital products and services. The gap between these two numbers indicates the economic growth that China could generate if policy makers and business leaders successfully unlock the Internet's full potential. Some RMB 10 trillion in annual GDP will be at stake in 2025 alone (Exhibit E3).[6]

Perhaps even more important, the next wave of Internet development will help China shift toward a model of economic growth that is based on productivity, innovation, and consumption. The Internet is fueling the ongoing process of moving China's industry from less productive to more innovative and technologically advanced business models. Indeed, much of the Internet's impact

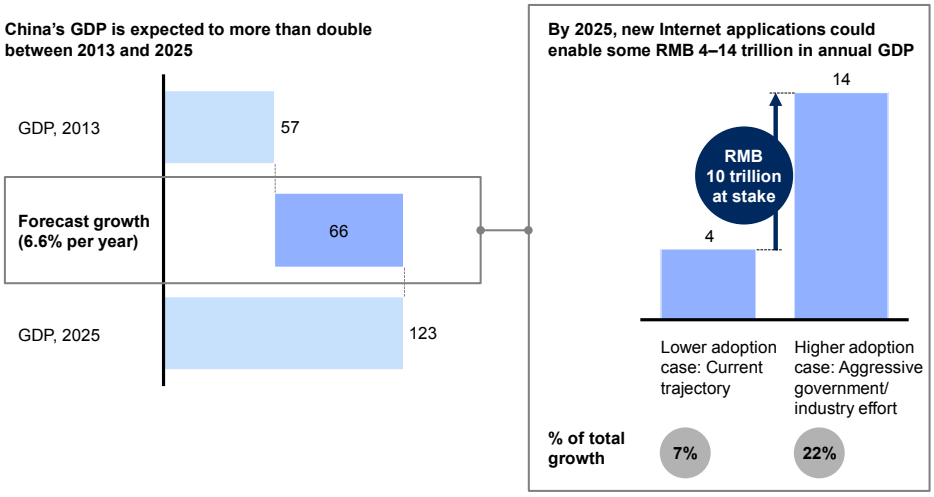
6 In 2013 terms.

will likely come in the form of productivity gains. As individual companies step up their adoption of Web technologies, they will streamline their operations, from product development and supply chain management to sales, marketing, and customer interactions. New applications of the Internet could enable 7 to 22 percent of China's labor productivity growth from 2013 to 2025.[7]

**Exhibit E3**

**The speed and extent of Internet adoption will shape China's future economic growth**

RMB trillion




NOTE: Numbers may not sum due to rounding.
SOURCE: McKinsey Global Institute analysis of growth projections from IHS

Our projections also consider the economy-wide spillover effect caused by a more competitive finance sector. Big data (to manage credit risks) and online channels (to reduce transaction costs) provide financial institutions with greater capabilities to increase lending to small and medium-sized enterprises—and they create favorable economics for doing so (see Box E1, "Unleashing the power of many: The Internet's impact on SMEs"). More efficient allocation of capital can potentially contribute RMB 450 billion to 1.5 trillion of the Internet-fueled GDP increase through 2025.[8]

Beyond its impact on GDP and productivity, the Internet will create convenience and generate substantial consumer surplus. Enhanced transparency and competition can lower prices while increasing the quality of goods—and the resulting savings becomes available for additional consumption. The Internet can also create broader benefits to society by connecting individuals with learning tools and huge stores of information and by enabling government at all levels to deliver public services more efficiently.

7 Given that the size of the working population is projected to decrease slightly, incremental GDP growth during this period can be almost entirely attributed to productivity growth (hence the similarity between the ranges of GDP and productivity outcomes).

8 In addition to reallocating capital from the large corporate sector to the SME sector, financial institutions will be better able to identify the most efficient companies *within* those two sectors. Although we did not assess this impact, it is substantial, and as a result, our estimated total impact is conservative.

### Box E1. Unleashing the power of many: The Internet's impact on SMEs

Small and medium-sized enterprises (SMEs) contribute some 70 percent of China's GDP and are an important source of employment and innovation. Within the SME sector, however, China could generate even more dynamic growth from its small and micro businesses, which contribute 35 to 40 percent of GDP, compared with 52 percent in Germany, 54 percent in Mexico, and 67 percent in Italy.[1] The smallest enterprises typically lag behind larger companies in terms of labor productivity—and that gap is even larger in China than in other major economies.

China's small enterprises have thus far been hesitant in adopting the Internet, but going digital neutralizes some of the disadvantages they have been facing. The Internet provides a platform for entrepreneurs with new ideas to scale up rapidly and at low cost, and it allows them to collaborate with others along the value chain and within a broader ecosystem. Cloud computing reduces the need for hefty investment in IT systems, while online marketing can be purchased in small increments to target specific consumer segments. E-commerce marketplaces offer instant and direct access to consumers, along with support services such as payment and logistics. The Internet can even improve export capabilities: many Chinese SMEs are becoming "micro-multinationals" that sell to overseas customers on B2B marketplaces such as Alibaba or Global Sources, as well as on foreign platforms.

Limited access to capital is a common challenge for SMEs, and especially so for the smallest enterprises. Yet this picture is changing, as the Internet gives lenders new tools for evaluating credit risk and lowering transaction costs, and as private banks and Internet finance providers inject new competition into the financial services sector. Alibaba, for instance, provides microloans to its e-merchants, and JD.com offers supply chain financing to its e-merchants.

Technology adoption by small and micro businesses could have a disproportionate impact on raising China's labor productivity. The Internet lowers barriers to entry and heightens competitive intensity, thus accelerating the growth of the most innovative companies. This dynamic eventually improves the performance of the broader economy.

1 Small and medium-sized enterprises are non-subsidiary, independent firms that employ fewer than 250 employees in the European Union and fewer than 500 in the United States. In China, SMEs are generally defined as companies with fewer than 1,000 employees. China's small and micro businesses are those with fewer than 250 employees, which makes them comparable to SMEs elsewhere.

## THE INTERNET MAY HAVE A NEUTRAL IMPACT ON OVERALL EMPLOYMENT, BUT SOME DISRUPTION IS INEVITABLE

The Internet is already reshaping China's labor market, and its impact is likely to grow over time. Despite the changes that will occur, the net impact on the total number of jobs from the Internet applications described in this report could be neutral to slightly positive. Additionally, these changes are taking place against a backdrop of strong economic growth and a workforce that will soon begin shrinking.

The most striking effect is likely to be on the composition of the labor market. Companies will need fewer workers to perform routine activities that can move online; some jobs will be lost, and roles will change. Simultaneously, the economy will need more workers with digital skills. Policy makers and business leaders will need to consider whether displaced workers have avenues for retraining and whether the education system is producing enough high-tech and specialized talent to meet the economy's future needs.

New Internet technologies are likely to automate some existing activities, but the resulting job losses can be offset by the increased wealth and consumption that the Internet generates. A previous MGI survey of more than 4,800 small and medium-sized enterprises found that as they adopted Internet technologies, 2.6 jobs were created for every job that was lost.[9]

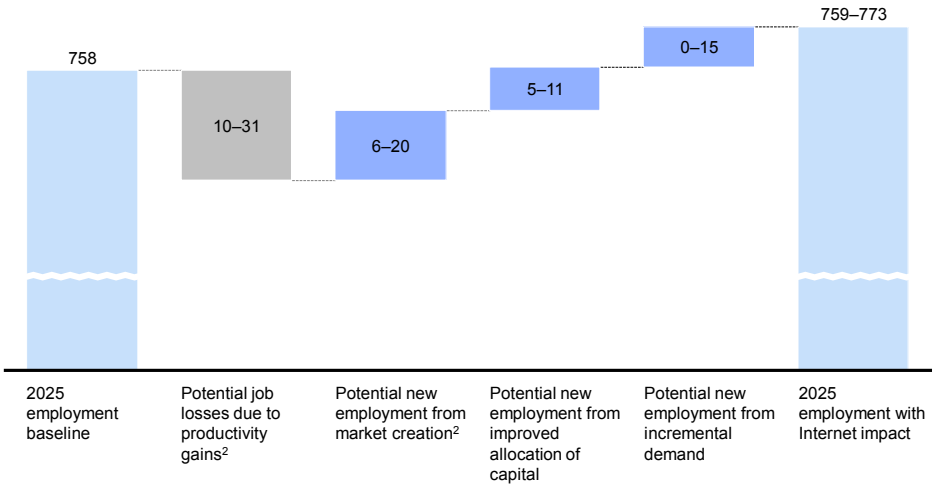
As competition intensifies and online price transparency puts pressure on margins, companies will have clear motivation to use the Internet to streamline their operations and become as efficient as possible. In the sectors we examined, Internet-related productivity gains from new applications could reduce employment by 1.3 to 4.0 percent, or approximately ten million to 31 million jobs, by 2025.

But the Internet is not just a tool for automation; it is also a force that rapidly expands markets. If the government and industry take the right steps to facilitate its development, the Internet could lead to the introduction of entirely new products and services, while allocating capital more efficiently and boosting demand across the economy. These factors could generate up to 46 million new jobs, including many positions requiring higher skills (Exhibit E4).

**Exhibit E4**

**Job losses caused by productivity gains could be more than offset by the creation of up to an estimated 46 million new jobs**

Million FTE[1]




1 Full-time equivalent. These estimates do not take into account the flexible and diverse working modes enabled by the Internet.
2 Extrapolated from detailed analysis of the employment changes likely to be caused by new Internet innovations in six representative sectors.
SOURCE: McKinsey Global Institute analysis

9 *Internet matters: The Net's sweeping impact on growth, jobs, and prosperity*, McKinsey Global Institute, May 2011. The surveyed businesses were in 13 countries, including China.

## The Internet's transformative impact on six sectors

The Internet is already generating enormous economic value in China. To illustrate the transformations taking place across the economy, this research analyzes six sectors representing a mix of industry and services, of discrete and process manufacturing, and of corporate and semi-public sectors. Companies are beginning to revamp traditional business processes to achieve cost savings, and in some cases, new billion-dollar markets have taken shape virtually overnight.

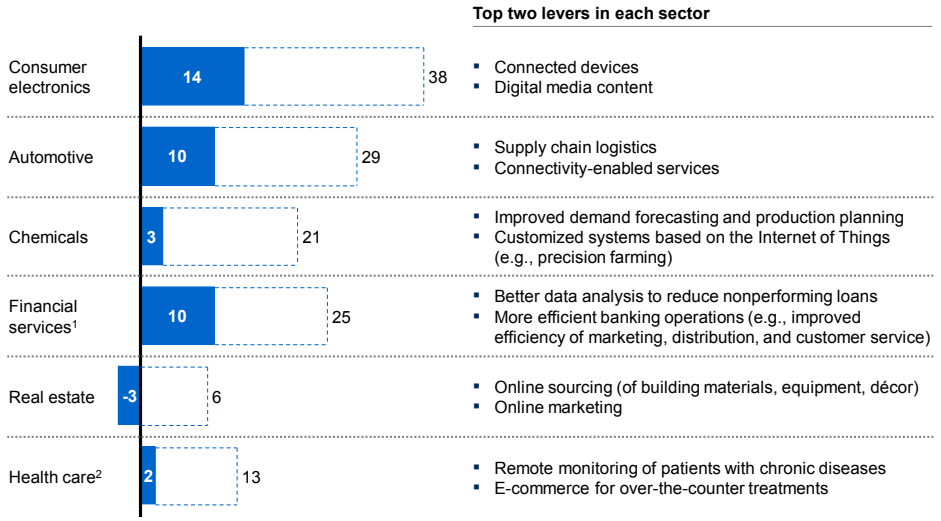
But at the same time, the Internet can unleash creative destruction. Since volatile industry dynamics will be at work, our research does not attempt to predict winners and losers. Instead, it examines major new Internet applications that are beginning to penetrate various sectors and takes a macroeconomic view, quantifying the value they can create throughout the economy. The results may not appear all at once, as companies will have to undertake considerable investment in the near term. But the impact will accelerate over time, and by 2025 the contribution to annual GDP will be substantial (Exhibit E5).

**Exhibit E5**

**Adoption of new Internet applications in these sectors will have substantial economic impact**

**Contribution of new Internet applications to GDP growth, 2013–25**

% of sector GDP growth




1 Does not include the effects of capital reallocation throughout the economy.
2 Refers to reduced health-care expenditures.
SOURCE: McKinsey Global Institute analysis

### CONSUMER ELECTRONICS: CREATING NEW MARKETS FOR INNOVATIVE DIGITAL PRODUCTS

The Internet has unleashed a remarkable burst of innovation in consumer electronics, including connected devices such as smart home appliances and Internet TVs. Haier, for example, has developed the U-home solution, which connects appliances with a home's entertainment, security, and lighting systems. Chinese consumers have already demonstrated a huge appetite for digital movies, TV shows, music, games, and other media content. In 2013, some 70 percent of China's Internet users used online streaming, and about half used

mobile online streaming.[10] Consumer cloud services for data storage, file sharing, and other uses are another major area for growth.

The industry is also harnessing the Internet for productivity gains. Companies can now source from a wider range of suppliers to find the exact inputs they need at the best price, and marketing can be more targeted when it is moved online. E-commerce for consumer electronics posted a compound annual growth rate of 103 percent from 2009 to 2012, compared with only 9 percent for offline sales.[11] Some companies are even crowdsourcing product development to gain consumer insights: smartphone manufacturer Xiaomi has an online community of fans whose recommendations for product improvements are reflected in weekly software updates.

The Internet will continue to have a substantial impact on the consumer electronics sector, contributing some 14 to 38 percent of the overall growth expected through 2025.[12] It could also boost employment in the sector and its associated value chains by up to 7 percent.[13] Most of this growth stems from the creation of new markets for smart appliances, Internet TVs, digital media content, and cloud computing services, which all depend on broader Internet coverage and increased bandwidth.

## AUTOMOTIVE: PAVING THE WAY FOR NEW SALES AND SERVICE OFFERINGS

The combination of slowing growth and excess capacity is increasing pressure on China's auto industry to boost productivity. The Internet will help Chinese automakers and other companies in the associated value chain meet these challenges and create new models for growth.

Leading manufacturers have been using real-time data to optimize inventory levels and transportation routes in their supply chains. In fact, McKinsey's work with China's automotive companies indicates that high performers turn over their inventory five times as fast as low performers. The Internet could also help automakers manage rising marketing costs as consumers go online to inform their purchase decisions. Škoda and Volkswagen are experimenting with selling cars on their own websites or on Tmall, while auto vertical websites like BitAuto and Autohome are growing rapidly.

Connectivity will open up a series of new markets and service opportunities. In addition to offering safety features and driving assistance, it can be used to deliver maintenance alerts and run remote diagnoses, saving servicing costs for dealerships as well as time for car owners. In China, GM's OnStar offers GPS

10 *33rd statistical report on Internet development in China*, China Internet Network Information Center, January 2014.

11 "Online retail series 2: Answering 4 key elec/appliance questions," Goldman Sachs, January 2014.

12 In all sector discussions, baseline projections are from IHS, while the Internet-enabled growth is estimated based on our research and extensive expert interviews. Productivity gains are estimated by assessing the affected cost base, adoption rate, and potential cost savings. New market creation is estimated by assessing the market penetration of new offerings, the ratio of incremental market growth vs. the existing market, and the value add of the new market.

13 In all sector discussions, employment estimates are for the sector itself and associated value chains only. These estimates do not include effects on cross-sector employment from capital reallocation and incremental demand.

and maintenance alerts, and BMW's ConnectedDrive provides remote control via smartphone. Mercedes-Benz recently launched the "Mercedes me" digital platform for providing service. Chinese automakers have been focusing on first-time buyers and necessarily know very little about them, but as customers trade up, connectivity could provide valuable insights that lead to future sales of vehicles and value-added services. The Internet of Things can also be used to track and even immobilize delinquent autos, making lenders and dealers more willing to extend auto loans to Chinese SME owners with insufficient credit histories.

China's used car market is still taking shape, but there is enormous room for growth. The used car market is expected to grow more quickly than new car sales, from three million vehicles sold annually today to more than 20 million by 2020.[14] E-commerce platforms such as Youxinpai and Cheyipai can help dealerships source quality used cars, help consumers find the right vehicle, and increase the transparency of information in each transaction—removing some of the major obstacles to market development today. Some leading sites allow easy comparison of used car listings, and momentum could continue to grow if independent services along the lines of Carfax and Kelley Blue Book in the United States evolve to provide vehicle histories as well as fair value estimates.

Major car rental and car service companies are already using online channels extensively to cut sales and marketing costs, while taxi and limo services are beginning to use the Internet to optimize fleet dispatching. Passengers can use mobile apps such as Didi and Kuadi to summon the nearest available taxi.

Internet technologies could fuel some 10 to 29 percent of the total GDP growth expected in the automotive sector by 2025, with 60 percent of this impact stemming from productivity gains. The Internet applications we identified are likely to have a roughly neutral effect on employment in the sector and its associated value chains, which could increase by up to 1.5 percent as a result of their impact. The employment opportunities created by new market expansion in used cars, connectivity-enabled services, and subprime loans for commercial vehicles could add up to 280,000 new jobs, more than enough to offset potential job losses of up to 200,000 from productivity gains in existing operations.

## CHEMICALS: HELPING THE INDUSTRY MOVE UP THE VALUE CHAIN

China's chemical industry is in transition as companies try to succeed in low-profit commodity-based segments while developing more sophisticated products. At the same time, growing environmental concerns have led to tighter regulations and higher costs, increasing the need to optimize production processes. Internet technologies could help chemical makers tackle these issues.

The Internet can improve forecasting and production planning by supplying detailed, real-time data on everything from suppliers' inventory and shipments in transit to downstream customer demand. Although adoption of these tools is still at an early stage in China, the major producers have strong incentives to move ahead on this front. The Internet can also enhance R&D capabilities, keeping companies on the cutting edge of science and industry trends and enabling

14 Based on projections from the China Automobile Dealers Association and the State Information Center, as well as McKinsey analysis.

collaboration with customers and external experts. E-commerce has gained only limited traction in the sector, but it is likely to grow as chemical sales expand in small and mid-size cities. A few companies have their own online channels or work with third-party platforms such as Alibaba, HC360, and Guangzhou Chemical Exchange Center.

Companies can use the Internet of Things to begin offering integrated product solutions such as water treatment for industrial companies. Precision farming is another potential area for growth; sensors can collect and process real-time data about moisture and nutrient levels in the fields and automatically deliver fertilizer and treatments as needed.

The Internet could contribute anywhere from 3 to 21 percent of the total GDP growth expected in the chemical sector through 2025. The resulting productivity gains may lower employment in the sector and its associated value chains by up to 3 percent. New market growth could counter this effect, but many of these areas depend on the continued development of the Internet of Things. Technology standards could accelerate this process so that companies can leverage an industry-wide platform instead of developing their own proprietary systems. Traditionally, the chemical sector spends less on IT than other industries, especially in China. To capture the full potential of the Internet, chemical companies will need to increase their technology investment.

## FINANCIAL SERVICES: SERVING NEW RETAIL AND BUSINESS SEGMENTS

Competition in financial services is intensifying as deregulation continues and Internet finance plays a larger role. These dynamics can erode margins, creating greater urgency for financial institutions to harness Web technologies to reduce costs and expand into new markets.

The Internet can provide a huge number of real-time data points that banks can analyze to reduce the risk of non-performing loans. Banks, securities firms, and insurance companies have built online channels for more efficient marketing and customer interactions. The Industrial and Commercial Bank of China estimates that an online transaction entails only one-seventh the cost of a transaction at a branch counter.[15] The combination of improved risk management and lower transaction costs will allow banks to serve more retail customers and SMEs.

Today Chinese consumers hold approximately 60 percent of their financial assets in deposits, but as the Internet reduces transaction costs, it brings down the minimum investment threshold for wealth management products. Online money market funds, discount brokerages, and third-party online marketplaces have begun to emerge. Internet payment platforms have provided a critical foundation for e-tailing and can also lead to increased consumption in offline retail.

The Internet is likely to contribute 10 to 25 percent of the GDP growth expected in financial services by 2025. Productivity gains may reduce employment within the sector itself by up to 5 percent, especially in sales and customer service. But greater use of Internet tools in finance will spur the creation of five million to 11 million jobs in other sectors throughout the economy as capital is allocated more efficiently.

15 ICBC annual report.

The regulatory framework governing financial services may need to be clarified to take new Web-enabled innovations into account. Internet finance increasingly links areas such as lending, payments, and investment that fall under different regulators, who will need to collaborate to provide predictable and consistent guidelines. The challenge for regulators will be to keep pace with change and strike a balance between encouraging innovation and mitigating risk. Regulators also need to establish clear guidelines for facilitating the data sharing needed to build a robust credit system while still protecting privacy.

## REAL ESTATE: MOVING FROM BRICKS TO CLICKS

Chinese home buyers and renters increasingly search online to find their ideal home. E-commerce platforms such as SouFun.com offer listings and advertisements from developers, agents, and individual owners combined with search engines. The ability to identify serious buyers more quickly is streamlining real estate searches and transactions, reducing marketing and carrying costs for developers and agents. Local governments can now establish online platforms for land auctions, providing new transparency. In addition, Taobao, China's largest C2C e-tailing site, launched an auction platform for foreclosed properties in 2012.

E-commerce platforms enable real estate developers, contractors, and hotel chains to purchase construction materials, facilities, equipment, and interior decoration online. They can consolidate volume from smaller buyers, reducing purchasing costs by anywhere from 5 to 30 percent, and allow small suppliers to connect with customers.

The Internet is also creating new business lines. Property management companies can build online communities that connect residents of a particular development, for example. These can be used for regular administrative and maintenance work or to offer value-added services, although privacy and security concerns remain an issue.

More broadly, the Internet is reshaping demand within commercial real estate. E-tailing is decreasing the need for retail space and increasing demand for modern warehouse properties with state-of-the-art logistics; some malls are becoming more entertainment- and experience-oriented. New platforms that connect travelers with homeowners who will rent out accommodations could put pressure on the hotel industry, although this model has been slower to take hold in China than elsewhere.

The quantifiable impact of the Internet within real estate has a wide range. It could lead to a 3 percent decrease in sector GDP or contribute as much as 6 percent to growth by 2025. As the Internet creates productivity gains and reshapes demand, it could also reduce employment by up to 8 percent within the sector and associated value chains. Beyond that, it will cause value shifts as buyers and renters become more informed and greater transparency reduces price premiums based on information asymmetries.

## HEALTH CARE: EXPANDING ACCESS WHILE LOWERING COSTS

China is engaged in an ambitious effort to reform its health-care system, which is coming under pressure as the population ages and chronic diseases become more prevalent. Hospital funding will be perhaps the most crucial determinant of whether this effort succeeds—and if it does, the Internet could be an important

tool for making the entire system more effective. Today many lower-tier hospitals, community health centers, and rural clinics lack technology systems. Even in top urban hospitals, information remains scattered. Shifting from paper records to an electronic health record system could dramatically improve China's public health management.

Structural imbalances represent one of the biggest challenges in China's health-care system. Eighty percent of resources are concentrated in urban areas, and patients prefer to crowd into the top hospitals for minor issues. Regional health information networks (RHINs) alleviate these problems by connecting leading hospitals with community health centers to coordinate referrals and treatment. RHINs are up and running in Shanghai and Beijing, and they are being set up in other major cities across the country. Telemedicine and remote monitoring are also improving access to resources by connecting rural patients with specialists hundreds of miles away. These concepts have advanced quickly in China, but to realize their full potential, incentives for hospitals and doctors will have to be aligned.

The Internet can also elevate the quality of care. Clinical decision support systems, for example, assist practitioners with diagnosis and provide alerts if there is a danger of an adverse drug reaction. Electronic health records and Web-enabled tracking systems can help with the implementation of standardized disease treatment protocols, while doctors can turn to learning portals (such as Ding Xiang Yuan) to stay on top of the latest research.

Consumers can now navigate the health-care system through platforms that rate and review hospitals and physicians. Because these tools make outcomes and patient satisfaction more transparent, they can increase pressure to improve performance. Online appointment systems could eliminate lengthy waits at top hospitals, while online consultancy platforms allow users to pose questions directly to physicians.

Pharmaceutical companies and medical device makers can use big data to expand research collaborations and streamline clinical trials. Electronic codes are being introduced to tighten supply chain supervision of drugs, eliminating counterfeits and preventing abuse. E-commerce could eventually expand the market for over-the-counter treatments, while online strategies could also improve marketing effectiveness.

The Internet can save some RMB 110 billion to 610 billion in annual health-care expenditures, which is 2 to 13 percent of the growth in health-care costs projected from 2013 to 2025.[16] Productivity gains may reduce employment in the sector and its associated value chains by up to 2 percent. On top of the direct savings, a more efficient system will bring enormous indirect benefits as it improves the quality of life and creates a healthier and more productive workforce.

Initiatives such as electronic health records and regional networks are progressing, but it will take government intervention to encourage hospitals, practitioners, pharmaceutical and device companies, and payers to adopt Web-

16 The health-care sector is excluded from calculations of the Internet's impact on overall GDP and employment, as its GDP is measured by total expenditure rather than the value of output. Any productivity-driven cost reductions in the sector, however beneficial, lower the sector's GDP.

based tools and systems. At the same time, privacy is paramount when it comes to personal medical information. New regulations will be needed to control risks, monitor the quality of emerging products and services, and guard against fraud and misleading information originating online.

## Capturing the Internet's full economic potential depends on government action and industry adoption

The Internet could add 0.3 to 1.0 percentage points to China's GDP growth rate and enable 7 to 22 percent of incremental GDP growth through 2025.[17] How much of this potential China will actually capture depends on the government's ability to create a supportive policy environment, the willingness of companies to go digital, and the adaptability of workers.

### CHINA'S GOVERNMENT FACES MULTIPLE CHALLENGES IN HARNESSING THE INTERNET FOR ECONOMIC GROWTH

Government entities at all levels now have an opportunity to increase their own effectiveness through the use of Web-based systems and tools. In their role as regulators, policy makers need to be fluent in the language of technology so they can participate in the flow of discussion with industry players and keep current with the latest innovations. The Internet's growth will require a policy framework that addresses the issues outlined below:

- **Enhancing privacy protection and data sharing.** A great deal of the Internet's potential for value creation stems from data sharing, which raises serious privacy concerns. In late 2012 China's government announced a preliminary set of rules regarding online privacy, but additional measures are needed to create strong penalties for violators and put sufficient resources into enforcement. A balanced set of regulations governing the kinds of information companies can share, the types of usage that are allowed, and the type of consumer consent that is required could remove constraints on big data adoption. The government can create significant momentum by making its own data sets publicly available.

- **Liberalizing markets to encourage new innovations.** In many cases, regulation will determine the degree to which companies can utilize the Internet. In financial services, the business lines that banks can move online will depend on regulations governing whether certain transactions have to be completed in person. Online platforms can develop the used car market, but regulations on cross-provincial transactions may need to be adjusted.

  One central issue to consider is "letting the market mechanism function."[18] Robust competition (both domestic and foreign) would accelerate productivity gains. A transparent market mechanism that allows for failures and resolutions will reinforce risk management among business owners. In addition, the Internet can create large network effects and a "winner takes all" dynamic.

17 The total growth potential was estimated by applying the ratio projected for the consumer electronics, automotive, chemical, financial services, and real estate sectors to industrial and service sectors across the entire economy.

18 *The decision on major issues concerning comprehensively deepening reform*, Third Plenary Session of 18th Central Committee of the Communist Party of China, November 2013.

The government may have to monitor how competition evolves to ensure that the broader economy benefits from maximum productivity gains. Balancing intellectual property protections and enforcement with the need to disseminate and combine new ideas will also be fundamental to unleashing innovation.

- **Developing workforce skills.** The Internet could significantly change the structure of employment. The government can ease this dislocation by collaborating with industry to ensure that training programs are available to help workers continually refresh their skills. China can also adapt school curricula to cultivate greater digital literacy and create a true education-to-employment pipeline. In fact, new digital education tools could accelerate China's ability to improve the quality of education across all regions at low cost.

- **Expanding Internet infrastructure and setting standards.** Household broadband penetration in China stood at only 39 percent in 2013, but the government aims to achieve 50 percent penetration and 32.5 percent 3G/LTE coverage by the end of 2015.[19] Building out networks is crucial to bringing more of the population online and facilitating industry adoption; cloud computing and big data applications in particular require sufficient bandwidth. Adopting international technology standards instead of unique domestic standards can also improve China's competitiveness and ability to export.

## COMPANIES HAVE TO PREPARE FOR RAPID CHANGE AND INTENSIFYING COMPETITION

Transforming a traditional company into a digital business involves rethinking everything from company culture to strategy, operations, organization, and partnerships. Below are some of the major considerations for business leaders:

- **Cultivating a "customer first" mentality.** The Internet gives customers new power to take their business elsewhere with the click of a mouse—so their needs have to guide every aspect of a company's operations. Consumers expect companies to deliver a seamless, convenient, and personalized user experience. Rather than focusing on mass production, companies can now use the Web to choose from a wider range of suppliers, glean customer insights, and produce a more complex portfolio of products that is better targeted to what consumers want. Chinese consumers are avid users of social networks, so adding social connectivity and building online communities can be powerful strategies for building word of mouth and brand loyalty. Perhaps the most crucial part of retaining digital customers is handling their personal data in a way that creates trust over the long term.

- **Adjusting strategy to prepare for a new wave of competition.** The Internet will intensify competition, and new winners are likely to emerge in a variety of industries. Larger incumbents, including state-owned enterprises, will have to adjust to the challenges that can arise from innovative newcomers or risk being caught flat-footed. Competition can now emerge rapidly from unexpected corners as barriers between sectors become blurred. Frequent testing and fine-tuning of the customer experience is critical, but teams must quickly zero in on the digital investments that create the most value. Business owners and CEOs will have to be deeply engaged as they undertake decisions

19 Pyramid Research, September 2013; *Broadband China*, State Council of China, August 2013.

that can radically affect how their companies do business. Up-front investment may worsen the cost structure in the short term, but winners can reap the benefits for years to come.

- **Transforming operations.** The Internet is forcing companies across all industries to rethink their operations and abandon old ways of doing business. Manufacturing operations need to become more flexible in order to respond to fast-changing markets. Messages and offerings have to be carefully tailored to be compelling on both online and mobile platforms. Incorporating big data can be a daunting proposition, but doing so can lead to better decision making and allocation of resources as well as customer insights. Technology investments and product portfolios may have to be revisited more frequently, and CIOs may need to have a greater voice in strategy.

- **Acquiring the right capabilities and determining the right organizational structure.** Companies will face increasing talent shortages, particularly for highly specialized roles using big data and advanced analytics. Larger firms may make targeted acquisitions of small tech firms to jumpstart their digital transformations. Companies may also need to develop their own talent pipelines through training for existing employees, industry collaboration, partnerships with education providers, or public-private efforts to design external training programs. The next step is to consider how to integrate digital roles into existing operations. In some successful cases, CEOs themselves have assumed the role of "digital champion." Companies may need to change their traditional function-based organizational structures to become more customer-centric.

- **Becoming more open to partnerships and outside collaboration.** Technology is increasingly challenging the old business model of keeping major value chain activities fully in-house. In certain segments, such as the mobile market, there is already a broader ecosystem of hardware and software developers, app developers, content providers, and makers of add-on products. To establish standards and build the broader market for the Internet of Things, AT&T, Cisco, General Electric, IBM, and Intel formed the Industrial Internet Consortium. Fully developing telemedicine and precision farming may require a similar level of cooperation among companies from different sectors.

□ □ □

With some 632 million users, China is already the world's largest Internet market. But its economy is on the cusp of an even greater wave of transformation as Chinese businesses go digital. Previous MGI research has found that a country's Internet maturity correlates with a sizable increase in real per capita GDP—so in other words, this shift can deliver growth and productivity gains that support higher living standards. The Internet may bring disruptive change, but companies that successfully compete at the forefront of innovation stand to create enormous value.

# 1. China's digital transformation

Picture a day in the life of a typical urban white-collar worker in China. She wakes to the sound of an alert on her smartphone, which shows her sleep pattern log, synchronized from her fitness wristband. She brings her smartphone to the breakfast table to skim through the day's headlines and uses an app to check the daily air quality index reading. On the commute to her office, where she works as a purchasing manager, she has a quick exchange with her team members on WeChat to share the news that their company's major competitor is buying up critical raw materials. After arriving at the office, she weighs in on the strategy her already-informed team members have devised on the enterprise social network and agrees to place a large online order for chemicals in response. During her lunch break, she watches short videos of her daughter, sent by her kindergarten teacher, and tracks the delivery status of a friend's birthday gift ordered from a Taobao e-merchant. Seeing that it has arrived, she confirms the payment. While she is at it, she transfers additional funds from her bank into her e-payment account to increase her investment in a money market fund. Leaving the office that afternoon, she uses her smartphone to summon a taxi and stream the latest episode of *My Love from the Star* during the ride.

With 632 million users engaged in similar types of online exchanges, the Internet has rapidly grown in both scope and influence in China. China is now one of the world's largest markets for PCs, smartphones, e-commerce, broadband, and the mobile Internet (Exhibit 1). Its e-tail market now stands at close to $300 billion in annual sales; it surpassed the size of the US market, becoming the largest in the world, in 2013.[20] Yu'ebao, a money market fund linked to Alipay's online payment platform, had attracted more than 80 million investors as of February 2014, just eight months after its launch.[21] More than 60 percent of Internet users in China use social networking.[22]

20 *2014 China online shopping report*, iResearch, May 2014.

21 Company news release, March 2014.

22 *2013 research on user behaviors of social applications*, China Internet Network Information Center, November 2013.

But while consumers have gone digital, many Chinese businesses have been slower to embrace this shift. Across most sectors of China's economy, the Internet holds the promise of large improvements in labor productivity, but most of these gains have yet to be realized. Integrating Web technologies into a company's operations is not a simple proposition: it requires up-front investment, new skill sets, a redesign of organization and processes, and a mindset that embraces change. But the payoff—both for individual organizations that come out on top and for the broader economy—can be huge. A great wave of disruption has just begun, and companies that move quickly can realize both significant cost savings and advantages in fast-evolving new markets.

**Exhibit 1**

**China's Internet has been consumer-driven rather than enterprise-driven**

**2013**

| | | China | United States |
|---|---|---|---|
| Consumer side | **Internet usage** | | |
| | ▪ Users | 632 million[2] | 277 million |
| | ▪ Penetration | 46% | 87% |
| | **E-tailing** | | |
| | ▪ Size | $295 billion | $270 billion |
| | ▪ Share of retail | 7–8% | 6% |
| | **E-commerce platforms** | Taobao/Tmall | eBay |
| | ▪ Items | 800 million | 550 million |
| | ▪ Active buyers | 231 million | 128 million |
| | **Smartphone penetration (share of installed base)** | 54% | 69% |
| | **Social networking among Internet users** | 60% | 73% |
| Enterprise side | **Enterprise cloud adoption rate** | 21%[3] | 55–63%[4] |
| | **SMEs Internet adoption ratio**[1] | 20–25% | 72–85% |

1 Positive survey responses for Internet use in procurement, sales, and marketing.
2 As of July 2014.
3 McKinsey China CIO survey, 2012.
4 Rates vary depending on types of cloud computing solutions.

SOURCE: Kable ICT Customer Insight survey, 2013; National Small Business Association survey, 2013; iResearch; China Internet Network Information Center; International Data Corporation; Strategy Analytics; US Census Bureau; Pew Research Center; National Small Business Association; McKinsey Global Institute analysis

Depending on the speed and extent of industry adoption, the Internet could add 0.3 to 1.0 percentage points to China's GDP growth rate. This could fuel some 7 to 22 percent of the incremental GDP growth expected through 2025—and by that point, it could translate into RMB 4 trillion to 14 trillion in annual GDP. This is a wide range of outcomes, and capturing the full potential will depend on whether government and industry take the right steps to facilitate the Internet's development.

The Internet will not only create economic momentum for China in the years ahead; it will also change the very nature of growth. The heavy capital investment and labor force expansion that fueled China's rise over the past two decades cannot be sustained indefinitely. The Internet, by contrast, can enable GDP growth that is based on productivity and innovation. It also accelerates the development of market forces, and as it heightens competitive intensity, the most efficient enterprises and best practices win out.[23]

23 William W. Lewis, *The power of productivity: Wealth, poverty, and the threat to global stability*, University of Chicago Press, 2004.

The Internet's overall impact on employment could be neutral or even slightly positive, but some jobs may be lost (or redefined), while workers with digital skills will be in higher demand. This period of adjustment will have to be addressed effectively. But wider industry adoption of Internet technologies could ultimately help to close the productivity gap that remains between China and the world's advanced economies.

## China has a large and rapidly growing Internet economy, as reflected in its iGDP

The Internet provides a platform for millions of daily online transactions and communications that make a significant contribution to individual economies. The "iGDP" indicator measures this impact by estimating how much of a country's economy is related to the Internet (see Box 1, "MGI's iGDP methodology," as well as the appendix).

### Box 1. MGI's iGDP methodology

The McKinsey Global Institute has developed the concept of "iGDP" as a quantitative measurement of the Internet's impact within a given economy. It uses the expenditure method of calculating GDP, assessing all the activities linked to the creation and use of Internet networks as well as Internet services. These include:

- **Private consumption**—the total consumption of goods and services by consumers via the Internet or to obtain Internet access, including hardware, software, broadband, mobile Internet access, smartphone consumption, and e-commerce
- **Public expenditure**—Internet spending for consumption and investment by the government, including software, hardware, services, and infrastructure
- **Private investment**—business investment in Internet-related technologies, including telecoms, extranets, intranets, and websites, as well as infrastructure
- **Trade balance**—including exports of business process outsourcing; e-commerce; and Internet-related goods, services, and equipment; minus all associated imports

Although it measures the outputs related to the Internet economy, iGDP does not translate directly into GDP because certain components may be interim inputs rather than final consumption. However, it is a good proxy of relative size and growth of the Internet economy in a given region.

MGI's original iGDP analysis examined 2009 data and found that, on average, the Internet contributed 3.4 percent to GDP in the 13 major economies that were studied. If measured as a sector, Internet-related consumption and expenditure were already larger than the agriculture or energy sectors in these 13 countries.[1]

1 For a full explanation of the iGDP methodology, see *Internet matters: The Net's sweeping impact on growth, jobs, and prosperity*, McKinsey Global Institute, May 2011, and *Online and upcoming: The Internet's impact on aspiring countries*, McKinsey & Company High Tech Practice, January 2012. The 13 countries measured were Brazil, Canada, China, France, Germany, India, Italy, Japan, Russia, South Korea, Sweden, the United Kingdom, and the United States.

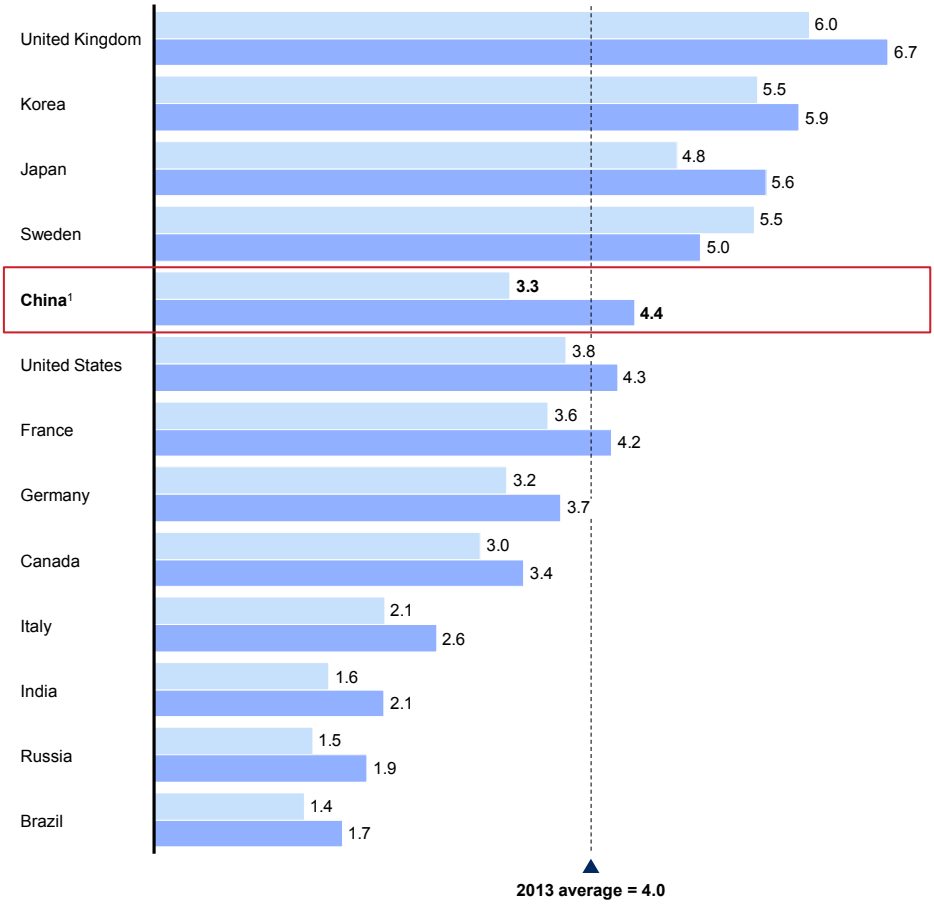
In 2010, China's Internet economy stood at 3.3 percent of its GDP, lagging behind most advanced economies. By 2013, its iGDP had reached 4.4 percent, moving China into the ranks of the global leaders (Exhibit 2).

**Exhibit 2**

**China's Internet economy is already larger than those of the United States, France, and Germany as a share of GDP**

**iGDP, 2013**

Internet-related expenditures as % of respective country GDP




1 The C2C (consumer-to-consumer) e-tailing category in most countries primarily consists of secondary-market transactions by individuals and is negligible. But in China, it encompasses sales by small enterprises and microbusinesses without company registration. If C2C is included, China's iGDP would be 7 percent, higher than that of any G7 country.

SOURCE: McKinsey Global Institute analysis

Viewed more broadly, China's Internet economy is even larger. C2C e-commerce is a small category in most countries and is therefore excluded from the iGDP indicator, but in China, it represents the majority of the e-tail market.[24] If C2C is included, China's Internet economy represents 7.0 percent of its GDP, higher than the level in any of the G7 countries.

24 The C2C (consumer-to-consumer) e-tailing category in China encompasses sales by small enterprises and microbusinesses without company registration, while C2C in other countries primarily consists of secondary-market transactions by individuals.

## China is on the brink of a digital transformation that can improve productivity

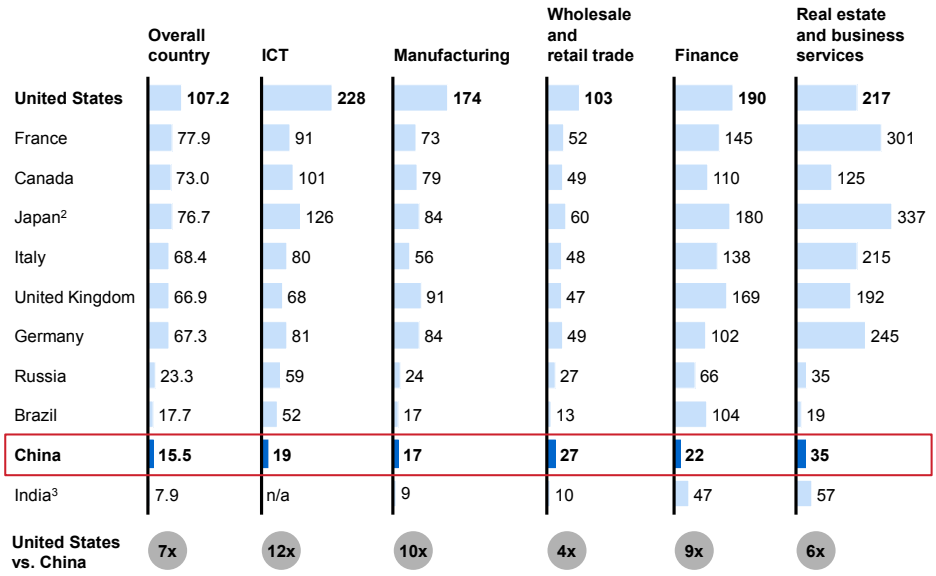
China has posted high rates of labor productivity growth in recent years, but its progress began from a very low base. As a result, its labor productivity remains well below the levels in advanced economies (Exhibit 3). China created $15,500 of GDP per worker in 2013, significantly lower than levels in the United States ($107,200), Japan ($76,700), and Germany ($67,300). A closer look at the sector level bears this out: US labor productivity in the ICT and manufacturing sectors, for example, was 12 and ten times higher than China's average labor productivity in those sectors, respectively, in 2013.

**Exhibit 3**

**China's labor productivity is lower than that of other major developed economies**

**Labor productivity by sector, 2012**[1]

GDP per worker
$ thousand


Overall country
ICT
Manufacturing
Wholesale and retail trade
Finance
Real estate and business services
United States 107.2 228 174 103 190 217
France 77.9 91 73 52 145 301
Canada 73.0 101 79 49 110 125
Japan2 76.7 126 84 60 180 337
Italy 68.4 80 56 48 138 215
United Kingdom 66.9 68 91 47 169 192
Germany 67.3 81 84 49 102 245
Russia 23.3 59 24 27 66 35
Brazil 17.7 52 17 13 104 19
China 15.5 19 17 27 22 35
India3 7.9 n/a 9 10 47 57
United States vs. China 7x 12x 10x 4x 9x 6x

1 In 2013 purchasing power parity terms.
2 2013 data.
3 Employment numbers for 2010; trade includes hotels and restaurants.

SOURCE: IHS; US Bureau of Economic Analysis; Eurostat; Statistics Canada; Ministry of Economy, Trade, and Industry (Japan); Rosstat (Russia); Annual Social Information Report (Brazil); China Labor Statistical Yearbook; Ministry of Labor and Employment (India); International Monetary Fund; International Labour Organization; McKinsey Global Institute analysis

China faces a growing imperative to continue making strong gains in productivity. The rapid economic growth of recent decades was fueled by an expanding labor force and heavy capital investment, but this model is coming under pressure, particularly as the population ages. In fact, China's labor force is projected to begin shrinking by 2015.[25] As the dependency ratio doubles over the next two decades, the savings rate is also likely to decline as older Chinese draw down their savings. To avoid a slowdown and continue to improve living standards, China will have to make its existing labor and capital stock more efficient—and wider technology adoption will be central to this effort.

25 *China 2030: Building a modern, harmonious, and creative society*, World Bank and Development Research Center of the State Council, People's Republic of China, February 2012.

The rapid growth of China's Internet economy is not yet reflected in its labor productivity performance. From 2010 to 2013, China's labor productivity increased by 26 percent, while the contribution of Internet-related output to GDP increased by 35 to 60 percent (depending on whether C2C e-commerce is included).

However, China appears poised to capture large gains as its companies step up their adoption of Internet technologies. According to McKinsey's latest survey of Chinese CIOs, the typical Chinese company spends 2 percent of revenue on IT, far below the 4 percent international average. These same respondents predict their IT spending will increase to 3 percent of revenue by 2015—and while that still leaves a large gap, it indicates clear momentum.[26] As Chinese companies digitize their operations on a wider scale, they will gain the ability to streamline operations, open new sales channels, accelerate the R&D process, and become leaner.

The Internet is likely to usher in disruptive change, but it is also a catalyst for faster productivity growth. We project that the new applications described in this report could contribute 7 to 22 percent of China's overall labor productivity improvement by 2025. Capturing this potential will be critical for China's future competitiveness, particularly as the country's labor costs increase and its demographic dividend diminishes.

## An analysis of six sectors shows the Internet can produce GDP and productivity growth as well as consumer surplus

The Internet is beginning to have an impact on all areas of the Chinese economy. E-tailing has changed the way retailers connect with customers; media companies are delivering news and entertainment via digital platforms; and Chinese students are beginning to use new digital learning tools. To assess how the Internet could affect the overall economy, we chose six sectors for detailed analysis: consumer electronics, automotive, chemicals, financial services, real estate, and health care. This list represents a mix of corporate and semi-public sectors and of industrial and service sectors, as well as discrete and process manufacturing.[27]

This research does not attempt to predict winners and losers within these areas, as volatile industry dynamics will be at work. Instead, it examines a set of major new Internet innovations that are beginning to penetrate these sectors in China and then considers a range of outcomes depending on how widely they are adopted. We take a macroeconomic view, quantifying the value these

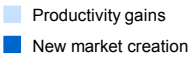
26 Dominic Barton, "Seizing China's new digital opportunity," *McKinsey on Business Technology*, number 29, spring 2013.

27 Government was excluded from the analysis for two reasons. First, there are greater constraints on Internet usage within government than in corporate sectors, which tend to have great incentives given the competition they face. Second, while GDP is defined as value add in non-government sectors, it is difficult to quantify various government services that are not priced on a market. Instead, the cost (in the form of salaries and payroll taxes paid plus consumption of fixed capital) is used in place of the value add. As a result, any use of Internet services to improve productivity could reduce the expenditures, and thus the GDP, of government sectors.

new tools and strategies can create through productivity gains and new market development, both within these sectors and throughout the economy. Among the Internet applications described in this report, the 15 with the greatest potential GDP impact are listed in Exhibit 4.

**Exhibit 4**

**The largest impact on incremental GDP growth will come from these 15 Internet applications**




| Sector | Lever | Estimated potential incremental GDP impact in 2025[1] RMB billion |
|---|---|---|
| Financial services | Better data analysis to reduce nonperforming loans | 280–800 |
| Financial services | More efficient banking operations | 200–230 |
| Health care | Remote monitoring of patients with chronic diseases | 70–340 |
| Chemicals | Improved demand forecasting and production planning | 50–255 |
| Consumer electronics | Connected devices | 55–210 |
| Real estate | Online sourcing (of building materials, equipment, decor) | 50–200 |
| Real estate | Online marketing | 75–170 |
| Financial services | Reduced transaction costs from Internet payment systems | 30–205 |
| Consumer electronics | Continued growth of digital media content | 60–140 |
| Chemicals | Customized systems based on the Internet of Things | 20–145 |
| Financial services | More efficient operations of securities and investment firms | 40–110 |
| Consumer electronics | Consumer cloud services | 45–100 |
| Real estate | Online community services offered by developers | 40–100 |
| Health care | E-commerce for over-the-counter treatments | 25–70 |
| Consumer electronics | Continued growth of e-commerce | 30–60 |

1 Ranked by the average value of incremental GDP impact in low and high scenarios.
SOURCE: McKinsey Global Institute analysis

Combining all the various levers we will discuss in the chapters that follow, our analysis shows that Internet adoption could potentially enable 6 to 20 percent of the total increase in GDP expected in these sectors between 2013 and 2025.[28] This could contribute to adding 0.3 to 0.9 percentage points to annual GDP growth. About one-third of this impact comes from the creation of entirely new markets, while the rest comes from productivity gains in existing value-chain activities.

Given that the six sectors profiled in this report accounted for about one-quarter of China's GDP in 2013, we extrapolated these results to determine the likely impact on the rest of the economy by assuming same degree of Internet impact within industrial and service sectors.

In addition to the impact within sectors, there will be a broader economy-wide spillover effect from the financial sector's ability to use the Internet to improve the way it allocates capital. Compared with their larger counterparts, small and medium-sized enterprises have more limited access to financing today. As a

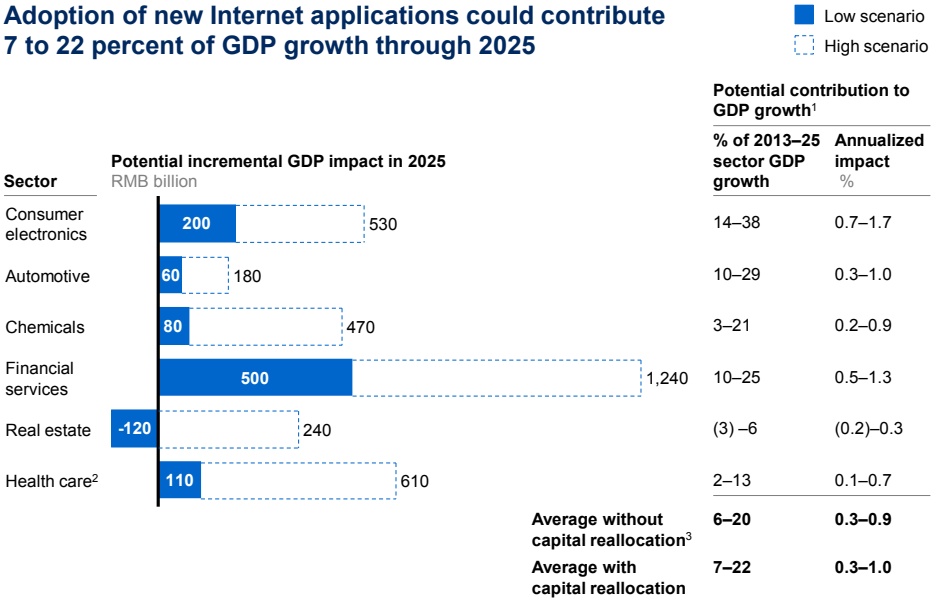
28 "Total increase in GDP" refers to the difference in real GDP (on 2013 terms) between 2013 and 2025. However, the health-care sector is excluded from calculations of the Internet's impact on overall GDP, as the GDP of public or quasi-public sectors such as health care is measured by total expenditure rather than the value add. Any productivity-driven cost savings in the sector, however beneficial, lowers the sector's GDP.

result, they tend to be efficient with capital, thus producing higher returns on investment than large corporations. But big data (to assess and manage credit risks) and online channels (to reduce transaction costs) can now provide financial institutions with greater capabilities to increase lending to SMEs—and they create favorable economics for doing so. Improved information transparency can also lead to more direct financing of SMEs. In addition, the Internet provides information transparency that can help lenders better differentiate the most competitive companies, forcing SMEs and large companies alike to "up their game" and thus raising the productivity of the overall economy. More effective capital reallocation could enable GDP growth of RMB 450 billion to 1.5 trillion[29] on top of the sector-specific impact described above. This would add 1 to 2 percentage points to China's GDP growth through 2025.

Including the effects of capital reallocation, the Internet could have an economy-wide impact that adds 0.3 to 1.0 percentage points to China's annual growth rate. It could fuel some 7 to 22 percent of the incremental GDP growth expected through 2025 (Exhibit 5). By that point in time, it could translate into RMB 4 trillion to 14 trillion in annual GDP.

**Exhibit 5**

**Adoption of new Internet applications could contribute 7 to 22 percent of GDP growth through 2025**




| Sector | Potential contribution to GDP growth[1] % of 2013–25 sector GDP growth | Annualized impact % |
|---|---|---|
| Consumer electronics | 14–38 | 0.7–1.7 |
| Automotive | 10–29 | 0.3–1.0 |
| Chemicals | 3–21 | 0.2–0.9 |
| Financial services | 10–25 | 0.5–1.3 |
| Real estate | (3) –6 | (0.2)–0.3 |
| Health care[2] | 2–13 | 0.1–0.7 |
| **Average without capital reallocation[3]** | **6–20** | **0.3–0.9** |
| **Average with capital reallocation** | **7–22** | **0.3–1.0** |

1 Includes spillover effects.
2 Here we refer to health-care expenditure savings. These savings cannot be translated directly into GDP gains, as GDP is measured differently for public and quasi-public sectors in national accounts. GDP in the government and health-care sectors is based on spending, not the value of output.
3 Health-care expenditure is excluded when calculating the average.
SOURCE: McKinsey Global Institute analysis

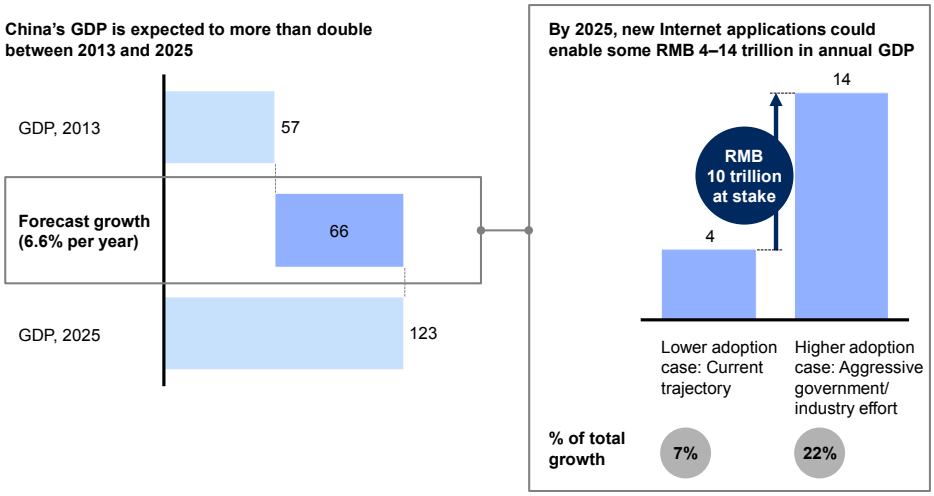
29 We project incremental GDP growth because more capital will flow into small and medium-size enterprises, and they offer higher returns on capital than large companies. We begin by projecting the growth of China's total pool of available capital (loans, equity, and bonds) from 2013 to 2025, based on IHS and McKinsey analysis. We then assume a higher ratio of capital flowing into SMEs as Internet technologies enable financial institutions to better serve these companies at lower cost. We further assume that this capital will generate higher EBITDA (earnings before interest, taxes, depreciation, and amortization), as has been the pattern in the past with Chinese SMEs. In addition, new capabilities within the financial services sector would not only reallocate capital from the large corporate sector to the SME sector; they would also allow financial institutions to identify the most efficient companies *within* those two sectors. Although we did not assess this impact, it is also an important dynamic. As a result, our upper estimate of RMB 1.5 trillion in impact is conservative.

These projections for GDP impact cover a wide set of outcomes, all of which assume that Internet penetration continues to grow. The low end of the range represents the current trajectory, or an assumption that trends already unfolding today continue to progress but existing constraints remain in place. The upper end assumes a more optimistic penetration rate in the future economy. This scenario can be achieved if the government quickly establishes a supportive policy framework and if industries move more aggressively to integrate Internet technologies into their existing operations and build new markets for digital products and services. (See the appendix for more detail on these assumptions.) In other words, some RMB 10 trillion in annual GDP could be at stake across the entire economy by 2025 (Exhibit 6).[30]

**Exhibit 6**

**The speed and extent of Internet adoption will shape China's future economic growth**

RMB trillion




NOTE: Numbers may not sum due to rounding.
SOURCE: McKinsey Global Institute analysis of growth projections from IHS

Within the sectors we analyzed, the Internet's largest potential for creating value is concentrated in four main areas:

- **Reduced transaction costs.** The Internet allows companies, consumers, researchers, and the public sector to communicate and collaborate instantly. It facilitates productivity gains from e-commerce, crowdsourcing, and Internet-enabled supply chain management. It also allows manufacturers to connect directly with consumers, cutting out middlemen.

- **Use of big data analytics.** Machines and people alike generate vast streams of data, and new tools equip companies with the ability to gather and analyze this information to enhance decisions and gain market insights at negligible additional cost. For instance, big data can enable accurate and cheap analysis of the credit risks of lending to small businesses and individuals. It also allows e-tailers to deliver personalized recommendations to consumers based on their past purchases.

30 The number is the difference between GDP impact in low and high scenarios, in 2013 terms. It was estimated by applying the ratio projected for consumer electronics, automotive, chemicals, financial services, and real estate sectors to private industrial and service sectors across the entire economy.

- **The ability to meet long-tail demand.** The Internet's reach and its ability to automate transactions make it much more cost-effective for businesses to fulfill demand for a more diverse range of niche or customized products.

- **Introduction of new competition.** The Internet dramatically lowers barriers to entry, making it possible for new businesses to launch quickly, scale up, and compete. It gives entrepreneurs access to low-cost resources, from cloud computing to payment systems. However, even as it lowers barriers to entry for the smallest enterprises, it can also give rise to "winner take all" dynamics. Some markets could become bifurcated, with many small players but only a very few dominant names at the top. Competitive intensity may render some business models obsolete and weed out companies that do not quickly adapt.

On top of the GDP impact, the Internet creates wider economic and societal benefits. Enhanced transparency, competition, and efficiency can lower prices and improve the quality of products—and the Internet empowers consumers to compare offerings from a wide range of companies with just a few clicks of a mouse. The resulting savings become available for additional consumption and allow consumers to purchase products and services of higher quality. In addition, consumers gain convenience and variety. Online medical appointment systems could eliminate the need to line up first thing in the morning and spend hours waiting at a hospital in hopes of seeing a doctor. Online real estate listings help potential home buyers zero in more quickly on the home that best fits their needs. Even more broadly, the Internet can spur an upgrade of workforce skills, while it provides individuals with access to huge stores of information and new learning tools. Governments at all levels have the opportunity to use the Internet to improve the delivery of public services, from traffic management and tax collection to education and disaster response. Many of these benefits are not captured by GDP projections, but their impact is no less real.

## The Internet can lower barriers to entry for SMEs and boost their productivity

SMEs, or companies with fewer than 1,000 employees, are an important part of the Chinese economy.[31] They contribute some 70 percent of GDP and are an important source of employment and innovation.[32] They also tend to have higher capital productivity than other companies—and that efficiency is born out of necessity, as capital is hard to come by for small enterprises. Within the industrial sector, the average return on assets is 8.2 percent for SMEs, compared with 6.6 percent for large enterprises.[33]

31 Small and medium-sized enterprises are non-subsidiary, independent firms that employ fewer than a given number of employees (250 in the European Union, 500 in the United States, and 200 in some other countries). In China, SMEs are generally defined as companies with fewer than 1,000 employees, while small and micro businesses are those with fewer than 250 employees. Therefore, we compare China's small and micro businesses with other countries' SMEs.

32 National Bureau of Statistics; *Report on the nationwide development of small and micro businesses*, State Administration for Industry and Commerce of the People's Republic of China, March 2014.

33 Unless otherwise specified, numbers for China in this section are estimated based on the 2008 census and on 2012 economics statistics from the National Statistics Bureau.

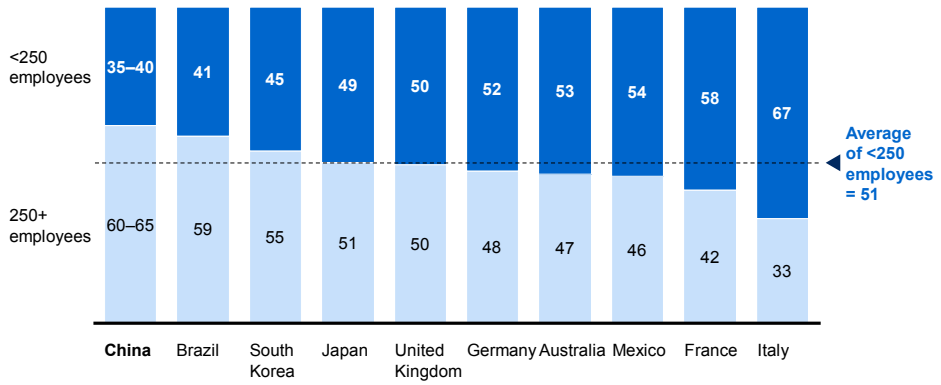
However, within the SME sector, China's small and micro businesses (those with fewer than 250 employees) contribute a much smaller share of GDP than comparably sized enterprises in other countries (Exhibit 7). Micro and small businesses contribute about 35 to 40 percent of Chinese GDP, compared with 52 percent in Germany, 54 percent in Mexico, 58 percent in France, and 67 percent in Italy.

Exhibit 7

**Small enterprises contribute to a much smaller share of GDP in China than in other countries**

Share of GDP generated by company size, 2012

%




1 China defines enterprises with fewer than 250 employees as small and micro enterprises, while other countries define them as small and medium-sized enterprises (SMEs).

SOURCE: 2008 China Economic Survey; State Administration of Industry and Commerce (China); CEIC database; World Bank; other national statistics from Ministry of Labor or statistics bureaus; McKinsey Global Institute analysis

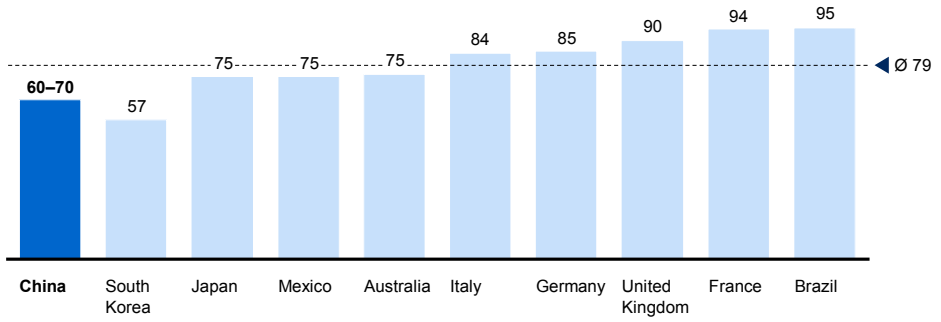
In addition, micro and small businesses lag behind large companies in terms of labor productivity, a finding that is especially true in China (Exhibit 8). In China, the estimated labor productivity of micro and small businesses is 60 to 70 percent of the national average, while it is 85 percent in Germany, 75 percent in Mexico, 90 percent in the United Kingdom, and 95 percent in Brazil.[34]

Exhibit 8

**China's small enterprises lag behind those in other major economies in terms of labor productivity**

Ratio of labor productivity in small enterprises[1] to national average, 2012

%




1 China defines enterprises with fewer than 250 employees as small and micro enterprises, which is comparable to the definition of small and medium-sized enterprises (SMEs) in other countries.

SOURCE: 2008 China Economic Survey; State Administration of Industry and Commerce (China); CEIC database; World Bank; other national statistics from Ministry of Labor or statistics bureaus; McKinsey Global Institute analysis

34 *Entrepreneurship at a glance 2013*, OECD, July 2013.

Small and micro enterprises could have a disproportionate impact on raising labor productivity in the overall economy. The Internet is a valuable tool for making these businesses more efficient, but its current penetration is not yet optimal. The majority of Chinese companies are part of the broader SME sector, and only 23.5 percent used the Internet for sales as of December 2013. Just 26.8 percent used the Internet for procurement, and 20.9 percent used it for marketing.[35] By contrast, 72 to about 85 percent of US small businesses responding to a 2013 survey reported using the Internet for similar purposes.[36]

Going digital can neutralize some of the disadvantages faced by Chinese SMEs today. The Internet provides a platform for entrepreneurs with new ideas to scale up rapidly and at low cost. SMEs can now collaborate with suppliers and vendors and improve supply chain management. They incur lower transaction costs and gain the ability to engage more deeply with customers, building insights and loyalty. They also gain access to affordable resources. Cloud computing, in particular, reduces the need for hefty investment in in-house IT systems; SMEs pay for data storage and computing power only when the need emerges. Online marketing can be purchased in small increments to target specific consumer segments. It once took years to establish a huge sales force and wide distribution network, but e-commerce marketplaces grant SMEs instant and direct access to consumers, along with associated support services, such as payment and logistics. They can also find and work with contract manufacturers on B2B e-commerce platforms. In addition, small businesses and even individuals have new opportunities to become providers in the "sharing economy," as models such as Airbnb allow anyone with a spare room to offer accommodations.

Limited access to capital is a common challenge for SMEs, and especially so for the smallest enterprises. Yet this picture is changing: the Internet gives lenders new tools for evaluating credit risk and lowering transaction costs, and private banks and Internet finance providers are injecting new competition into the financial services sector. Alibaba, for instance, provides microloans to its e-merchants, and JD.com offers supply chain financing to its e-merchants.

The Internet can also boost the export capabilities of SMEs, turning them into "micro-multinationals." They can now participate in global wholesale e-commerce platforms such as Alibaba.com (which already has more than 30 million registered buyers) and Global Sources (which has one million active buyers).[37] They can also reach overseas consumers directly by listing on foreign B2C or C2C platforms—in fact, 3,835 Chinese sellers were already on eBay with more than $100,000 in sales as of November 2012.[38] But in order to export successfully, SMEs need to compete on price, quality, design, and delivery terms in addition to building meaningful brands and after-sales service.

When SMEs have a platform for growth, collaboration, and experimentation, the overall economy benefits. The rate of innovation increases, as new ideas and offerings can now be tested and rolled out quickly, easily, and cheaply,

35 *33rd statistical report on Internet development in China*, China Internet Network Information Center, January 2014.

36 *2013 small business technology survey*, National Small Business Association, September 2013.

37 Alibaba data from *China cross-border e-commerce market research report 2012–2013*, iResearch, September 2013; Global Sources data from company investors relations report.

38 *Greater China exporters' index*, eBay Inc., November 2012.

introducing more competition and thus raising productivity in various industries. The growth of SMEs in China could also create a disproportionate number of jobs (due in part to the fact that the sector is starting from a position of relatively lower labor productivity than the rest of China's economy). Helping SMEs flourish could mitigate the job losses that could occur as labor productivity improves in the rest of the economy. China's ability to realize these benefits will depend on whether SMEs recognize the advantages the Internet can provide and are willing to adopt it in large numbers.

## The Internet may have a neutral or positive impact on overall employment, but some disruption is inevitable

The Internet is already reshaping China's labor market, and its impact is likely to grow over time. Despite the changes that will occur, the net impact on the total number of jobs could be neutral to slightly positive. Additionally, these changes are taking place against a backdrop of strong economic growth and a workforce that will soon begin shrinking.

Although the productivity gains associated with Internet technologies are likely to lead to some job losses as existing activities are automated, these losses may be offset by the new market creation and increased consumption that the Internet generates. Previous MGI research included a global survey across 12 countries (including China) of more than 4,800 SMEs and found that as Internet technologies spread, 2.6 jobs were created for every job that was lost.[39]

As competition intensifies and online price transparency puts pressure on margins, companies will have clear motivation to use the Internet to streamline their operations and become as efficient as possible. In the sectors we examined in China, Internet-related productivity gains could reduce employment by 1.3 to 4 percent, or approximately ten million to 31 million jobs, by 2025.

At the same time, the Internet is not just a tool for automation; it is also a force that rapidly expands markets. If government and industry take active steps, it can lead to the introduction of entirely new products and services, while allocating capital more efficiently and boosting demand across the economy. New markets for digital products and services are likely to generate some six million to 20 million jobs, raising employment by 1 to 3 percent. The Internet's positive impact on startups and SMEs could further add some five million to 11 million jobs, increasing employment by an additional 1 to 1.5 percent.

In addition, e-tailing could continue to generate incremental consumption, potentially raising employment by 0.5 to 2 percent. Evidence that e-tailing is boosting consumption was revealed in an analysis of 2010 and 2011 data, and a more recent examination of 2012 and 2013 data shows this trend is continuing.[40] The positive effect of e-tailing overlaps to a degree with the impacts described above, but nevertheless, it should produce at least some positive addition to overall employment.

39 *Internet matters: The Net's sweeping impact on growth, jobs, and prosperity*, McKinsey Global Institute, May 2011.

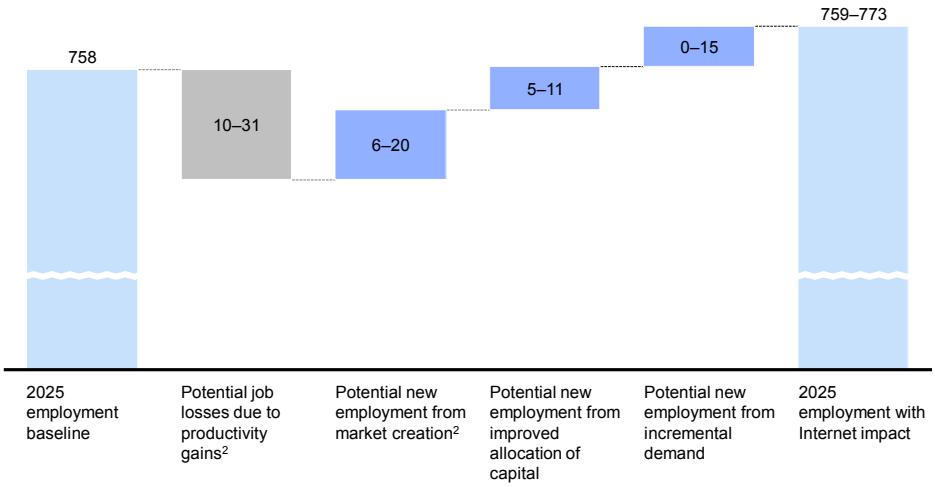
40 *China's etail revolution: Online shopping as a catalyst for growth*, McKinsey Global Institute, March 2013.

In total, the Internet could generate up to 46 million new jobs (including many positions requiring higher skills), more than enough to neutralize the job losses stemming from productivity gains. This combines the effects of creating new markets, allocating capital more efficiently across the economy, and boosting demand. The impact on total employment should be neutral to slightly positive (Exhibit 9).

**Exhibit 9**

**Job losses caused by productivity gains could be more than offset by the creation of up to an estimated 46 million new jobs**

Million FTE[1]




1 Full-time equivalent. These estimates do not take into account the flexible and diverse working modes enabled by the Internet.
2 Extrapolated from detailed analysis of the employment changes likely to be caused by new Internet innovations in six representative sectors.
SOURCE: McKinsey Global Institute analysis

While China may not lose a large number of jobs, the composition of the labor market and the nature of work are likely to change. Jobs linked to activities that can be automated could be lost (or redefined). Simultaneously, the economy is likely to need more workers with digital skills. Policy makers and business leaders will need to consider whether displaced workers have avenues for retraining and whether the education system is producing enough high-tech and specialized talent to meet the economy's future needs.

Companies are likely to move more rapidly to deploy the Internet to save costs within their existing operations, and these are precisely the changes that are likely to reduce the need for labor. By contrast, government action may be needed to pave the way for new Internet-fueled markets that can create jobs. Growth in the SME sector will be especially critical in managing this transition. And while the Internet causes this labor market disruption, it can also provide some tools to help address it. Online programs and digital learning tools could prove to be the most effective vehicles for workforce retraining.

□ □ □

China's Internet has already given rise to a dynamic ICT sector, thriving social networks, and the world's largest e-tailing market. But its biggest impact is yet to come, as traditional industries begin to harness Web technologies to become more efficient and launch new business models. Beyond creating value for companies and individual users, the Internet will prove to be a powerful catalyst for economic growth, productivity gains, and higher living standards. In the chapters that follow, we will examine how these changes could play out within specific sectors.

# 2. The Internet's growing impact in the consumer electronics, automotive, and chemical sectors

As the Internet transforms the way individual sectors do business, it is generating enormous economic value. Much of its impact will come in the form of productivity gains as Internet technologies allow companies to revamp and streamline many traditional business processes, from product development and supply chain management to sales and marketing, achieving major cost savings. The Internet is also creating entirely new markets for products and service offerings that may not have existed even a few short years ago. In some cases, billion-dollar markets have taken shape virtually overnight.

E-commerce is fundamentally reshaping the retail sector and leading to greater consumption.[41] New digital learning tools and Web-based offerings such as massive open online courses hold the promise of delivering higher-quality education for underserved populations. In manufacturing, the Internet allows companies to collaborate with suppliers and partners while fully optimizing their own operations. To illustrate the transformations taking place across the economy, this research analyzes six sectors representing a mix of industry and services, of discrete and process manufacturing, and of corporate and semi-public sectors.

This chapter takes an in-depth look at consumer electronics, automotive, and chemicals, where the gains associated with the Internet are likely to be realized and captured by the sectors in question and their customers. The following chapter, by contrast, will examine a set of sectors that provides broader types of economic "infrastructure." In those cases, Internet adoption is likely to create significant spillover benefits to the wider economy or to society at large.

The three sector profiles that follow portray industries that are beginning to undergo rapid transformations in both products and processes. Consumer electronics, in particular, has become synonymous with the "next new thing" as it unveils high-tech digital devices and smart systems that change the way individuals interact with their environment. The automotive industry is using the Internet to redesign its traditional processes for the 21st century while developing new aftermarket sales, expanding the market for used cars, and introducing inventive new car-sharing services. In addition to maximizing their operational efficiency to improve the bottom line, chemical companies have new opportunities to reinvent themselves as integrated solutions providers. For all three of these sectors, we will examine a set of levers created by new uses of the Internet and outline scenarios for their future adoption and potential for value creation. In each case, the decisions of individual companies will largely determine the speed and extent of the changes the Internet can unleash.

41 *China's etail revolution: Online shopping as a catalyst for growth*, McKinsey Global Institute, March 2013.

## Consumer electronics: Creating new markets for cutting-edge digital products

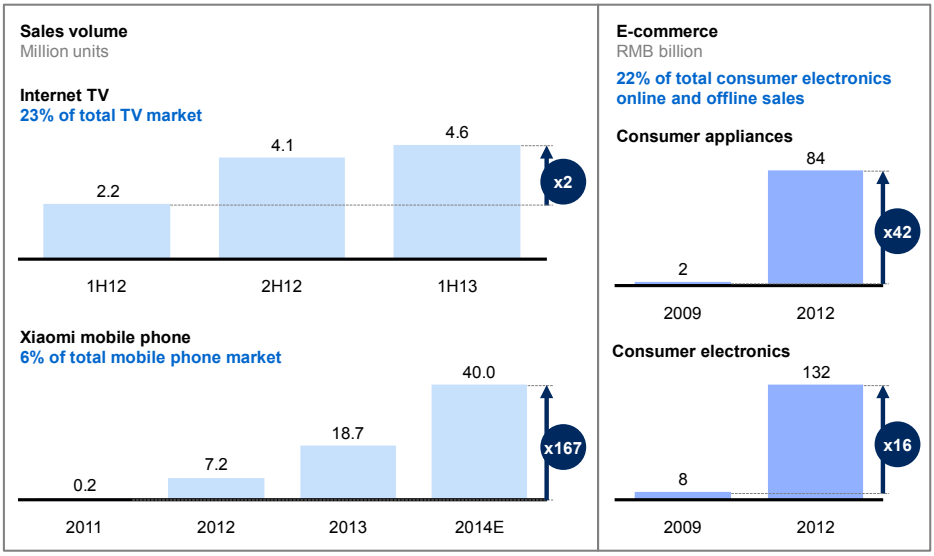
China's consumer electronics market—including appliances and digital products—has posted a compound annual growth rate of 18 percent since 2007, reaching RMB 1.4 trillion in sales in 2013.[42] But competition is intensifying, and major players are facing the challenges of adapting to new business models while maintaining profit margins.

The Internet has already had a significant impact on the consumer electronics sector by enabling technology development and product innovation, particularly in smart home appliances and digital products. In addition, it has lowered barriers to entry for small enterprises and startups. Companies with creative business models, such as Xiaomi (see Box 2, "Xiaomi leverages the power of Popcorns"), have been able to seize market share quickly. E-commerce is becoming the industry norm, and the remarkable growth of new products and platforms means that companies have to adapt to a continually changing industry landscape (Exhibit 10).

**Exhibit 10**

**The Internet has sparked rapid growth in sales of consumer electronics**

**Major Internet-enabled CE products**




NOTE: Not to scale.

SOURCE: Internet Data Center Report 2013; Bohai Securities analyst report 2013; Goldman Sachs analyst report 2014; McKinsey Global Institute analysis

42 Euromonitor from trade sources and national statistics, 2013.

### Box 2. Xiaomi leverages the power of Popcorns

Founded in 2010, Xiaomi, a leader in Chinese smartphone manufacturing, has designed a business model for the Internet age—and by 2013, its revenue already exceeded $5 billion. It has established an online user group community to collect information about the most-wanted product features and improvements, and it uses the group's insights to refine the next generation of operating systems and devices.[1]

Before a product launch, Xiaomi creates a social media stir, starting with the chairman's Weibo account. The buzz is amplified by the "Popcorns," as fans of Xiaomi are known. Many of them are key opinion leaders or moderators in multiple online forums, and they enthusiastically promote new products (often for free, simply due to their passion for the brand).

Xiaomi has designed online pre-ordering campaigns to create strong demand. Fans go online to share tips about how to "grab" a device within seconds of when it becomes available, and many "panic buy" a phone. In 2012, the company offered 50,000 units of a new model in one batch, and they sold out in less than three minutes.[2] The online pre-ordering model can save the costs of setting up an offline distribution network and sales channel.

Xiaomi has built its customer loyalty program around the Popcorn community and social media. The community organizes regular offline gatherings, and Xiaomi provides customer service through Weibo and other online channels to complement its offline after-sales centers.

1 Karan Girotra and Serguei Netessine, "How Xiaomi beats Apple at product launches," *Bloomberg View*, June 2, 2014.

2 "Fifty-thousand units of Xiaomi cellphones sold out in two minutes and fifty-one seconds," *Security Times China*, December 2012.

## IMPACT AND ADOPTION

The Internet has unleashed a remarkable burst of innovation in consumer electronics, giving rise to a host of new product offerings—from cutting-edge devices to digital content—while transforming business processes.

### Connected devices

Home appliances, televisions, and other digital products can now connect to the Internet and offer new functionalities with the help of operating systems and apps.

#### *Smart home appliances and solutions*

Smart home appliances and systems allow consumers to control their home devices remotely, better manage utility and energy expenses, and enhance home security. Meiling's CHiQ refrigerator, for instance, can transmit food images to its cloud data center, which automatically recognizes the images. It then provides consumers with information about each item's purchase date and quantity. Nest Labs, which Google recently acquired, offers a smart thermostat to make energy consumption more efficient by learning a household's usage patterns. Haier has developed the U-home solution, which connects appliances and the home's entertainment, security, and lighting systems.

The current adoption rate for these types of products in China is low (about 10 percent for smart laundry machines, 5 percent for smart air conditioners, and only 1 percent for smart refrigerators).[43] From the demand side, consumers do not yet consider smart appliances and solutions must-haves, so they are reluctant to pay a premium. From the supply side, the market is not mature, and there would be large costs involved in marketing to educate customers.

43 "Smart TV competition continues," Bohai Securities, December 2013.

There are two types of players, with different strengths and weaknesses, in this market. Traditional consumer electronics manufacturers, such as Haier and LG, aim to sell more hardware with a price premium. They have well-known brand names and established distribution channels, but their "closed" platforms are not compatible with third-party hardware, and consumers are disinclined to replace all of their old equipment with one brand's products.[44] Meanwhile, vertical players and startups could have low costs and great flexibility to support different models produced by different vendors, but their unfamiliar brand names and limited distribution capabilities represent major barriers. The winner of this battle remains uncertain, and competitors could even collaborate to establish a de facto standard to develop the market and provide clearer value propositions to consumers.

### *Internet TV*

TVs have become highly commoditized items. Major brands are seeking to differentiate themselves by offering unique functionalities. Internet TVs with browsers and Internet access are rapidly gaining market share. In the first half of 2012, about 4.6 million were sold in China, and the market is expected to grow more than 17 percent per year in the next five years.[45] Samsung released the UHD 4K smart TV in 2012 and offered the Samsung Evolution Kit in 2013; online streaming players such as LeTV have also launched Internet TV and set-top box products.[46]

Factors limiting the adoption of Internet TVs include higher prices, the widespread availability of other devices for streaming content, and the complexity of connecting smart TVs to home networks and the Web. Despite an increase in the availability of TVs with embedded connectivity, consumers still primarily access online content using other devices, such as set-top boxes. However, traditional TV vendors will probably provide Internet access as a default in the future.

The business model for Internet TVs is changing. Because Chinese consumers are so price sensitive, vendors are making little money from hardware; instead, they aim to profit from services such as media content and advertisements. For example, LeTV provides its set-top box hardware for free but charges RMB 490 for a 12-month subscription. This model has led to growing collaboration between TV manufacturers and content providers. In 2013, TCL partnered with iQiyi (an online steaming company and subsidiary of Baidu) and launched TV+ products.[47]

### *Infotainment wearable devices*

According to an iResearch forecast, about 6.75 million wearable devices were sold in China in 2013, generating revenue of RMB 2 billion.[48] In addition to versions that are customized for the health-care, fitness, professional, and military markets, these devices (including smart glasses and smart watches)

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44 A closed platform is a software system in which the carrier or service provider has control over applications, content, and media and restricts convenient access to non-approved applications or content.

45 "Smart TV competition continues," Bohai Securities, December 2013; NPD Display Search Q2 2012; iSuppli; Gartner.

46 Company websites.

47 Company websites.

48 "The concept of smart wearable devices attracts attention again," *Jinghua Times*, May 30, 2014.

can be used to provide information and entertainment to consumers. The best-known example (although it is not yet available in China) is Google Glass, which can track movement and performance and provide navigation, translation, and other information. Smart watches such as the Samsung Galaxy Gear, Sony SmartWatch, and Pebble Watch provide functions typically associated with smartphones (receiving and notifying the user of incoming calls, messages, emails, and so forth).

From 2010 to 2013, about 75 percent of venture capital funding for wearables went to health care and fitness, and only 21 percent went to infotainment.[49] The future of infotainment devices depends on manufacturers' ability to offer differentiated products and build a richer ecosystem with developers.

### Digital media content

Further penetration of devices such as smartphones, tablets, computers, and Internet TVs will promote the continued development of media content, including streaming TV programs and movies, streaming music and music downloads, online gaming, and online reading.

In these four categories, both penetration rates and future growth are promising. In 2013, some 70 percent of Chinese Internet users were taking advantage of Web-based streaming, and about half were using mobile streaming.[50] Digital music and gaming have even higher adoption rates (about 65 to 85 percent).[51] The current adoption rate for digital books, newspapers, and magazines is relatively low—less than 2 percent—but it is expected to post a compound annual growth rate of more than 20 percent from 2013 to 2017.[52] Though digital music and reading represent significant cannibalization of the traditional music and publishing industries, online streaming and gaming are mainly creating new demand and expanding their markets.

Despite the rapid growth of digital content, major media players are struggling to establish feasible business models, just as they are in developed economies, as consumers have come to expect free content.

### Consumer cloud services

Cloud computing can enable consumers to use a server's processing power for individual computing needs, such as running applications, storing data, and more. The most familiar uses, offered by Baidu, Apple, NetEase, Qihoo 360, and other companies, include data storage and document sharing. The rapid development of online data storage might not cannibalize local storage and hard-drive sales significantly in the near future, because it might take time to build consumer confidence in the reliability and privacy of the cloud. Beyond the common uses of cloud computing, some companies are offering consumers value-added services, such as analysis of health data read by sensors.

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49 Capital IQ 2013, based on deal value data for 51 companies for which venture capital and private equity funding details were available

50 *33rd statistical report on Internet development in China*, China Internet Network Information Center, January 2014.

51 *China's content value chain*, Samsung Securities, November 2013; Yolanda Zhang, *China gaming market 2013–2017: Forecast and analysis*, IDC, July 2013.

52 *Global media report 2013*, McKinsey Global Media and Entertainment Practice, October 2013.

The future development of cloud computing services for consumers depends on smartphone penetration and infrastructure improvements to provide adequate bandwidth. In addition, technology development must further drive down the cost of data storage, processing, and analysis. Regulation and customer education are also needed to ease privacy and security concerns.

### Productivity gains

Internet services can pave the way to productivity gains in areas such as R&D and product design, sourcing and supply chain management, marketing, sales, distribution, and after-sales services. The section below examines the parts of the value chain where the Internet could lead to leaner and more efficient ways of doing business and looks at the prospects for adoption in these areas.

#### *Collaborative R&D*

Some consumer electronics companies are making creative use of the Internet for faster R&D and more innovative product design. Engineers and developers can now collaborate with experts from supplier companies to create innovative and differentiated products or to fine-tune existing products. Managed properly, this type of Internet-enabled R&D can also reduce costs and time to market. If the collaboration involves consumers, direct online engagement with them can generate insights, target products more precisely to consumers' real demands, and increase customer satisfaction and brand loyalty. As mentioned above, Xiaomi has built a community of fans who provide feedback and recommendations for product design and improvement. The company selects a few top ideas to address and releases software updates every week. In 2013 and 2014, Lenovo held a Chuangke competition in which 50,000 participants contributed 100,000 product ideas; some participants even developed their products with funds raised on crowdsourcing platforms.[53]

There are different levels of openness in Internet-enabled R&D. Quite a few companies are trying to leverage customer insights, but the biggest players are more cautious when it comes to testing customer feedback for new product launches due to concerns regarding confidentiality and information leaks before the product hits the market. The adoption of crowdsourcing in the core elements of R&D is even lower because of deeper concerns regarding intellectual property protection for fundamental technology.

#### *Online sourcing*

The consumer electronics industry has a limited number of major suppliers, which makes purchasing prices transparent. There is not much room for cost savings through online sourcing, although the Internet can enable better inventory and supply chain management. It can also facilitate real-time auctions, collaborative buying, and other creative sourcing approaches.

#### *Online marketing*

Manufacturers' ability to cut costs and reach customers more effectively through online marketing depends on their own creativity. Typical online marketing approaches such as paid searches and pushed ads can be expensive, and the savings may be small if companies are just shifting their marketing budgets from

53 "Promoting technology innovation: Lenovo Chuangke competition launched," *CNET News*, January 2014.

offline to online channels. To enjoy the benefits of online marketing and reduce the wasted views of traditional TV advertising, companies need to find the "sweet spot," including more accurate targeting based on browsing history and behavior data.

The Internet also enables online marketing to reach a wider customer base and permits more innovative strategies. Xiaomi has successfully enlisted its fans and enthusiasts to broadcast the brand name, and its reliance on social networking as its primary strategy keeps marketing expenses to a minimum. Baidu has developed several creative marketing products in conjunction with its business customers. Its "brand district" integrates texts, photo images, and videos in response to consumer searches for a company name. Companies can also mine consumers' search data and discussions on other Baidu platforms (such as Tieba and Zhidao) to determine "brand assets" or select "brand ambassadors."

### *E-commerce*

E-commerce for consumer electronics has expanded rapidly, with a compound annual growth rate of 103 percent from 2009 to 2012, compared with only 9 percent for offline sales. In 2012, consumer electronics was the second-biggest category in e-commerce sales, with a share of 18.4 percent.[54]

Although e-commerce can provide obvious benefits—including more sales of long-tail products and fewer distribution layers, which leads to lower markups—it has so far proven to be a challenging environment for traditional consumer electronics manufacturers. Many benefits have accrued to consumers in the form of lower prices, as online price transparency puts enormous pricing pressure on manufacturers. Many companies choose to outsource distribution and online sales to e-commerce marketplaces (such as Tmall and Taobao) or independent merchants (such as JD), which also need to take a share of their margins. Players who want to undertake e-tailing by themselves have to overcome many hurdles, including more complicated SKU and inventory management, the need for warehouse improvements, and the need to build last-mile-delivery capabilities. The players who manage to address these issues will come out as winners; until they do, consumers will continue to reap the lion's share of the benefits.

For small enterprises with a single product or a limited product portfolio, e-commerce helps to lower entry barriers. Companies such as appliance maker Xiaogou originally lacked the scale or capability to build up offline networks, but now they can take advantage of online platforms for marketing and distribution to earn quick wins. Because they use e-commerce as the major or only sales channel, they do not have to worry about cannibalizing existing offline models.

### *Online customer service*

The Internet can streamline customer service functions by enabling remote diagnosis and repair. GE has used this approach with its NewFi home repair service, which is built on big data. Baidu is developing similar services that direct consumers to the closest repair locations using smartphones.[55] Though remote repair services cannot fully replace technicians' physical visits, they can

54 "Online retail series 2: Answering 4 key elec/appliance questions," Goldman Sachs, January 2014.

55 Clint Boulton, "GE repairman defrags your fridge," CIO Journal blog, *Wall Street Journal* online, July 6, 2012; expert interviews.

potentially improve repair efficiency and accuracy, reduce call center costs, and raise customer satisfaction.

### *3D printing*

Another disruptive technology that could affect consumer electronics is 3D printing. The price of 3D printers for consumer use is coming down, and individuals now have the ability to download designs from the Internet, then print toys or cosmetics at service bureaus or even at home. Some global companies are also using it to produce high-priced, potentially customized items such as medical implants and aerospace parts. In contrast, consumer electronics tend to be mass produced, and the technology may have less potential in their production, either by consumers or by manufacturers (although it does have some applications for mass customization, such as mobile phone cases with uploaded designs). However, 3D printing may have greater uses in the sector for rapid prototyping, which can reduce product and development cost by 65 to 90 percent and reduce lead time by 80 to 85 percent (although it does not need to be done through the Internet).[56]

## POTENTIAL IMPACT ON GDP AND EMPLOYMENT

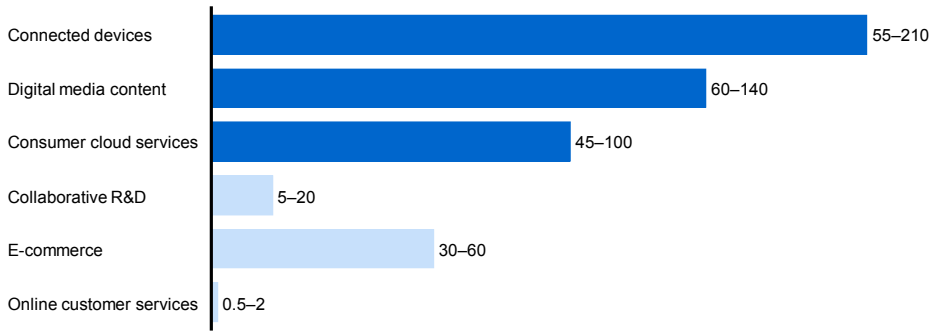
The Internet may account for additional GDP of RMB 200 billion to 530 billion, which is equivalent to 14 to 38 percent of the total GDP increase expected for the consumer electronics sector from 2013 to 2025 (Exhibit 11). At the same time, depending on the degree of Internet adoption, the sector could add 140,000 to 245,000 jobs (the equivalent of up to 7 percent of sector employment), as new market creation more than offsets the potential cuts that could result from increased productivity in existing activities.[57]

**Exhibit 11**

**Greater Internet adoption in the consumer electronics sector could add up to RMB 530 billion in GDP by 2025**

**Potential impact on GDP in 2025**

RMB billion




| | |
|---|---|
| **Total** | **200–530** |
| **% of sector GDP increase, 2013–25** | **14–38%** |

SOURCE: McKinsey Global Institute analysis

56 Stratasys website; "Aero engine parts made of SLM," MTU Aero Engines, May 2012.

57 This employment estimate considers only the impact of the Internet applications described above on the consumer electronics sector and its associated value chains. It excludes cross-sector impacts from capital reallocation and incremental demand.

As much as 85 percent of the incremental GDP could come from new market creation, particularly incremental sales and margins from connected devices and consumer cloud computing services that did not previously exist.[58] These new markets would also generate 170,000 to 330,000 jobs. Though digital media content and consumer cloud computing services will create substantial value, labor productivity in these industries is much higher than in other parts of the sector, so their contribution to incremental employment gains is not as significant.

Any remaining value creation could come from productivity gains. The industry can take advantage of innovations such as collaborative R&D and online customer service. Streamlining existing activities could result in the loss of 32,000 to 84,000 jobs, however. Overall, the sector's productivity is projected to more than double from 2013 to 2025, with Internet technologies potentially enabling 7 to 23 percent of these gains.[59]

## AGENDA FOR MAJOR STAKEHOLDERS

The Internet can be a double-edged sword for consumer electronics manufacturers. It offers big rewards to the winners but poses major challenges and tighter margins for many companies. The Internet is enabling sophisticated new products, but cycle times are speeding up and small-batch production of niche offerings adds complexity to the R&D pipeline, supply chain management, and production planning. In addition, e-commerce can help manufacturers reduce channel markups and obtain customer insights, but it also creates fierce price competition that can lower margins (especially if online marketing expenses increase sharply). Companies also need to integrate their online and offline channels to deliver a seamless customer experience and avoid pricing conflicts between these channels.

Government can help in a number of areas to realize the full potential of the Internet in the consumer electronics industry. Smart home appliances, Internet TV, digital content, and cloud computing services all require improved infrastructure, such as broader data signal coverage, increased bandwidth, and higher connection speeds. The government has announced the goal of having 250 million broadband accounts by the end of 2015.[60] But China's average net speed in 2013 ranked 90th among all countries at only 3.45 megabits per second (Mb/s), compared with 22.1 Mb/s for South Korea and 13.3 Mb/s for Japan.[61] The industry's development depends on efforts to close the gap.

58 New market potential is based on analyzing projections from multiple sources regarding the industry's future growth rate and growth in penetration rates for individual new products and services. We then subtract growth that may cannibalize offline sales and estimate the value creation associated with this incremental growth.

59 "Productivity" as used here is defined as sector GDP divided by labor. Sector GDP projections are from IHS, while labor is projected based on current labor size and growth of the overall labor force, adjusted for the relative GDP growth of the sector vs. the overall economy. To estimate the size of Internet-enabled productivity gains, we analyze projections from multiple sources regarding the industry's cost base that may be affected by each lever, the rate of adoption, and the cost savings involved. See the appendix for further details and sources.

60 *12th Five Year Plan for the Telecommunication Sector*, State Council of China, October 2010.

61 *China Internet in 2013*, Content-aware Data Report, 2013; *State of the Internet report 2013*, Akamai.

Government regulations regarding broadcast content distribution specify that all Internet TV and set-top box manufacturers have to cooperate with eight online media platforms. This might affect consumers' adoption of Internet TVs and set-top boxes, as well as manufacturers' willingness to invest. There are currently many "free" sources of digital TV programs, movies, music, and e-books. It may take a long time to regulate the market in terms of copyright protections, and the government's role will be vital. A clear and up-to-date copyright environment will enable companies to capture more profits from online streaming, digital music and gaming, and digital books and articles.

Concerns about personal privacy and data security remain a major obstacle that prevents wider consumer adoption of cloud computing services. Accusations emerge from time to time that companies have compromised consumers' private information or used personal data improperly. Laws and enforcement are needed to establish clear protections.

## Automotive: Paving the way for new sales and service offerings

Since 2000, China's passenger car production has posted a compound annual growth rate of more than 25 percent—and in 2010, China overtook the United States as the largest single-country new-car market. Supported by the rising number of high-income urban households and low automotive penetration, China is expected to contribute 35 percent of total growth in the world's automotive market between 2011 and 2020.[62] By 2020, automotive sales in China are forecast to reach close to 24 million—a figure that would top sales in the European or North American market.[63]

The sector is maturing rapidly, but its recent burst of growth led producers to build excess capacity. China's car market will continue to outpace growth in most parts of the world, but the expansion of the past decade is likely to slow.[64] The combination of slowing growth and excess capacity is increasing pressure on the entire industry to boost productivity. The Internet can play a large role in helping Chinese automakers and other companies in the associated value chain meet these challenges—and it is opening entirely new channels for growth.

### IMPACT AND ADOPTION

China's automotive sector is well established, and incumbent companies have been using the Internet for quite some time for e-commerce, which has reduced their transaction costs. What is new, however, is the increasing use of the Internet among end consumers and the rising adoption of the Internet of Things.

62 Arthur Wang, Wenkan Liao, and Arnt-Philipp Hein, *Bigger, better, broader: A perspective on China's auto market in 2020*, McKinsey & Company Automotive & Assembly Practice, November 2012.

63 IHS.

64 Arthur Wang, Wenkan Liao, and Arnt-Philipp Hein, *Bigger, better, broader: A perspective on China's auto market in 2020*, McKinsey & Company Automotive & Assembly Practice, November 2012.

We see four major areas of impact.[65]

### Productivity gains in existing value chain activities

The Internet allows original equipment manufacturers (OEMs) to take a more collaborative approach to product development. The Internet makes it possible to gain deeper customer insight that can be incorporated into product development. Volkswagen launched the People's Car Project in 2011 to develop new concepts; in addition, various OEMs have been working with search engines to understand which features resonate with consumers. Greater use of the Internet could potentially reduce R&D costs and deliver more of what consumers want. In addition, this newfound ability for engineers throughout the supply chain to interact is especially useful in the auto sector, where the product development cycle is long, products are not standardized, and the supply chain is exceptionally complicated. Almost half of the respondents in a 2014 McKinsey survey of Chinese OEMs said that their suppliers and other vendors have huge influence on car design. However, there is a large gap between the R&D operations of joint-venture OEMs and those of local OEMs; the Internet can help local firms meet the challenge of developing those capabilities.

The Internet could deliver its biggest savings within OEMs' supply chains and logistics operations, which account for 10 to 20 percent of their cost of goods. Leading players have been using real-time supply chain data to optimize inventory levels and transportation routes. McKinsey's work with China's automotive OEMs indicates that high-performing companies turn over their inventory five times as fast as low performers—and the Internet can help to close this gap so that working capital can be more efficiently deployed in other areas. Anji Logistics, which was spun off as a fully owned subsidiary of the Shanghai Automotive Industry Corporation, specializes in using the Internet of Things to manage logistics for dozens of Chinese OEMs. The rest of the market can realize significant cost savings by catching up with the early adopters and their best practices. Excellence in supply chain management will be critical: future market growth may be uneven, and as consumers become more sophisticated, their preferences are also likely to differ significantly across China's diverse regions and across various market segments.

Last but not least, the Internet could make the sales and marketing costs associated with new car sales more productive. The Internet already accounts for about one-fifth of media spending by the major OEMs in China, and for good reason: More than ten million auto-related searches are made per day through Baidu alone.[66] Greater numbers of consumers are using the Internet as a tool in their purchase decisions to compare features on different models and research their questions. They increasingly come into dealerships much more informed, looking only for specific offline experiences that can't be addressed online. This high-quality traffic to stores will substantially increase dealerships' conversion rates, saving marketing expenses. Major OEMs such as Škoda and Volkswagen are experimenting with selling cars on their own websites or on Tmall, an

65 There are additional possibilities for developing autonomous cars, smart-grid–connected electric vehicles, and urban traffic-management systems. We chose to not cover these applications in this report, either because of the limited role of the Internet or the automotive sector's limited control over them. Autonomous cars rely more heavily on advanced control and sensory systems than on Internet services, while the other two applications are more related to utilities and the public sector.

66 *2013 automotive industry analysis report*, Baidu Data Analytics Center, April 2014.

independent B2C marketplace. Auto vertical websites like BitAuto (Yiche.com) and Autohome are also growing rapidly. While online channels cannot deliver certain experiences (such as test driving), they can certainly reduce the need for dealership employees to convey basic information to consumers and could probably reduce the space required for model display at dealerships as well. Today online and offline channels still work quite independently, but deeper integration could yield greater efficiencies.

### Connectivity-enabled opportunities

Major Chinese OEMs responding to a 2014 McKinsey survey expect that more than 80 percent of cars sold in China will have connectivity built in by 2020. Connected cars are already delivering additional services, including safety responses, driving assistance, and convenience (such as parking information). In China, GM's OnStar offers GPS and maintenance alerts, and BMW ConnectedDrive provides remote control via smartphone. Mercedes-Benz recently launched the "Mercedes me" digital platform for providing services. As connected cars have begun to enter the mainstream, OEMs will be able to create alternative revenue streams by shaping clear benefits for drivers.

Connectivity could potentially help automakers deepen customer relationships. So far Chinese automakers have been focusing on first-time buyers and know very little about them. However, as more and more consumers are ready to upgrade and trade up, companies could potentially mine the information gained from connectivity to retain their consumers with value-added services and targeted marketing.

The Internet of Things can also track and even immobilize delinquent vehicles. Although this practice has not gained wide acceptance in most other international markets, it could help Chinese SME owners with insufficient credit histories obtain auto loans and thus a chance to own the vehicles required for their businesses. Beiqi Foton, for instance, has started to include its self-developed telematics system on its heavy-duty trucks; the company states that the use of connectivity on vehicles purchased with subprime auto loans could increase its commercial vehicle sales by 10 percent.[67]

The Internet of Things opens up new possibilities for aftermarket sales, which could be an important source of growth as new car sales slow in China. It can be used to deliver maintenance alerts, provide software updates, and run remote diagnoses, saving servicing costs for dealerships as well as time for car owners.

Connected vehicles do raise some privacy concerns, however. Consumers might need to get used to the new interactions with OEMs and other users of vehicle data and to express their preferences regarding these uses.

67 Beiqi Foton press release.

### Productivity gains and market expansion in transportation services

The Internet offers multiple avenues for growth in transportation services. Online channels can help car rental companies and sharing services improve the efficiency of their sales and marketing spending. Major names, including eHi and Ctrip, are already using online channels extensively, and this trend will likely continue as consumers become increasingly Internet-savvy.

Taxi and limo services could also use Internet services to optimize fleet dispatching. Mobile apps such as Didi and Kuadi already allow passengers to summon the nearest available taxi using their smartphones. While these services have grown rapidly, they are mainly limited to China's largest cities, and their adoption has been driven by heavy subsidies offered by Internet payment players. Further adoption is possible as smartphone penetration grows.

Under the right conditions, the Internet could greatly expand the taxi- or car-sharing market with new offerings like Uber or Lyft. Policies to discourage individual vehicle ownership, for example, could facilitate car sharing (as has happened in Europe, where the Amsterdam Smart City project offers WeGo, an online peer-to-peer platform that allows residents without cars to rent directly from car owners in their neighborhood). In China, Beijing, Guangzhou, and Shanghai have all introduced restrictions on car use due to worsening traffic conditions and air pollution, and other cities might follow suit.

### Development of the used-car market

In most mature markets, used car sales exceed new car sales and represent a major profit source for the industry. But China's fledgling used car market is much less developed than those in advanced economies. The ratio of used car sales to new car sales was less than 1:4 in China vs. 3:1 in the United States in 2012. China faces some unique challenges in scaling up this market, including a lack of well-developed sales channels, consumer preference for new cars, a lack of transparency on pricing and vehicle histories, and regulatory limitations. If these challenges can be successfully addressed, China's annual used car sales could potentially exceed 20 million units by 2020, reaching parity with new car sales.[68]

E-commerce and online platforms such as Youxinpai and Cheyipai can bridge the information gap and also help dealerships source quality used cars, help consumers find the right vehicle, and increase the transparency of information in each transaction—removing some of the major obstacles to market development today. Some leading sites allow easy comparison of used car listings, and more potential can be unleashed if independent services along the lines of Carfax and Kelley Blue Book in the United States evolve to provide vehicle histories as well as fair value estimates.

Government can facilitate the development of a broader used car market through strengthening regulations regarding supervision of used car sellers, establishing a public information service platform for used car trading, and amending local regulations that restrict circulation of used cars (such as cross-provincial transaction and tax regulations).

68 Based on projections from the China Automobile Dealers Association and the State Information Center, as well as McKinsey analysis.

## POTENTIAL IMPACT ON GDP AND EMPLOYMENT

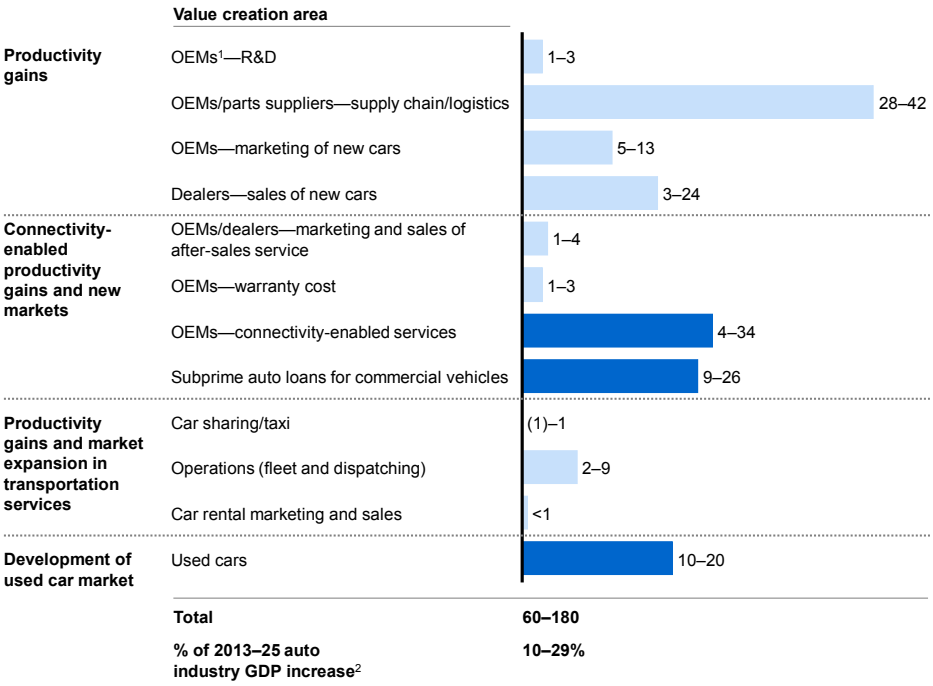
Greater use of these Internet applications in the automotive sector may enable incremental GDP of RMB 60 billion to 180 billion, or 10 to 29 percent of the auto sector's projected GDP growth between 2013 and 2025 (Exhibit 12). The Internet could fuel 8 to 24 percent of the sector's overall productivity gains during this period.

**Exhibit 12**

**Adoption of Internet applications in China's auto sector could contribute to up to RMB 180 billion in GDP by 2025**

**Potential impact on GDP in 2025**

RMB billion




1 Original equipment manufacturers.
2 Includes original equipment manufacturers, suppliers, and dealers only.
SOURCE: McKinsey Global Institute analysis

About 60 percent of the incremental GDP would come from productivity gains in existing operations, the majority of which is driven by manufacturers realizing savings in sales, marketing, and logistics.[69] These efficiencies could potentially reduce employment by about 40,000 to 120,000 in the OEM value chain and by about 20,000 to 90,000 in transportation services. The Internet efficiencies described above offer clear, immediate benefits and are mostly within the direct control of industry incumbents, which have strong incentives and sufficient capabilities to implement them.

69 To estimate the size of productivity gains, we analyze projections from multiple sources regarding the industry's growth rate, the industry's cost base that may be affected by each lever, the growth rate of adoption, and the cost savings involved. New market potential is based on analyzing projections from multiple sources regarding the industry's future growth rate and growth in penetration rates for individual new products and services. We then subtract growth that may cannibalize offline sales and estimate the value creation associated with this incremental growth. See the appendix for further details and sources.

Roughly another 40 percent of the incremental GDP could come from developing new markets for used cars, connectivity-enabled services, and subprime loans for commercial vehicles. These markets could possibly generate 96,000 to 280,000 new jobs.[70] This would largely neutralize the Internet's impact on overall sector employment. However, the development of these markets hinges to a greater degree on government action.[71]

## AGENDA FOR MAJOR STAKEHOLDERS

The Internet is increasingly penetrating the automotive sector as technology evolves and companies seek a competitive edge. But abundant opportunities remain, especially for greater collaboration along the OEM value chain and in new connectivity-enabled business areas. While many OEMs are already experimenting with online-to-offline (O2O) sales and marketing, they can also reap significant benefits by better integrating these two channels. They can also use the Internet of Things to improve supply chain management and logistics and to branch out into new Internet-enabled markets such as used car sales and subprime auto financing.

Given the safety requirements in the automotive sector, new providers entering these markets from the technology side will likely have to work with traditional companies operating within the OEM value chain to gain a foothold. Locking in the best partnerships with offline companies could be an important strategic move. Incumbents will also have to watch for new competitors emerging from the technology side; some US technology companies, for instance, are beginning to innovate in the automotive space, and their presence could one day prove to be disruptive.

The full potential for almost RMB 200 billion of incremental GDP in the automotive sector will be realized only if new Internet-enabled markets live up to their promise. Their development also hinges on policy changes in areas such as cross-provincial transaction and tax regulations for used cars, as well as privacy and data usage for connectivity-enabled services and auto loans. Car-sharing and taxi markets could also warrant increased policy support from the government due to the substantial social benefits they could generate (in the form of reduced traffic congestion and environmental costs). Options include encouraging sufficiently large taxi pools to ensure timely service, providing subsidies for fleet purchases or gas, imposing a congestion charge on privately owned vehicles, assigning dedicated taxi parking spaces near popular locations, and establishing regulations to define liabilities for car sharing.

70 This assumes that market development focuses on car sharing rather than taxi services. An additional 25,000 to 43,000 jobs could be created if market development shifts toward additional taxi services, which require drivers.

71 These employment estimates consider only the impact of the Internet applications described above in the automotive sector and associated value chains. It excludes cross-sector impacts from capital reallocation and incremental demand.

## Chemicals: Helping the industry move up the value chain

The Chinese chemical market has experienced more than two decades of robust expansion, posting a compound annual growth rate of 12 percent from 1990 to 2011 and reaching RMB 8.1 billion in 2013 sales.[72] Already the world's biggest chemical market, China is expected to account for about 60 percent of global demand growth from 2011 to 2020.[73]

But Chinese chemical producers confront many of the same challenges facing the broader manufacturing industry. In the race to meet rapid demand growth and keep up with competitors, some companies overinvested in what is now excess capacity in segments such as methanol, polyvinyl chloride, and even vitamins.[74] The industry is now in transition as companies try to exit low-profit commodity-based segments and move up the value chain into more sophisticated products. At the same time, China's growing environmental issues have led to tighter regulations and have increased the need to optimize production processes. Internet services could help Chinese chemical makers tackle these issues, as we will outline below.

### IMPACT AND ADOPTION

We see four major areas for impact, comprising both productivity gains and the creation of new markets and business lines.

#### Collaborative R&D

The Internet can transform the R&D capabilities of chemical companies, enabling them to access a wide range of external information and keeping them on the cutting edge of science and industry trends.

The Internet offers new ways for companies to collaborate with customers and external experts around the world on new product ideas. Online crowdsourcing platforms such as SpecialChem.com, Cheminno.com.cn, and Innocentive.com allow companies to post R&D challenges; users who solve them are paid to transfer the resulting intellectual property. AkzoNobel, a Dutch multinational, built its own online crowdsourcing platform to solicit external R&D partners. Chinese chemical companies have not adopted these tools very widely, indicating untapped growth potential. But intellectual property protection remains a big concern, making some hesitant to share the critical research problems they want to tackle in an open forum. Companies may instead reach out directly to targeted R&D institutions such as universities.

#### Demand forecasting and production planning

Manufacturers have long used demand forecasting and production planning to address uncertainties and improve operational efficiency. The Internet will improve these capabilities by supplying detailed, real-time data on everything from suppliers' inventory and shipments in transit to downstream customer demand. This will allow them to boost transparency, tighten inventory control, and maximize production capacity. Dow Chemical, for example, has used big

72 National Statistics Bureau, 2013.

73 Sheng Hong, Nathan Liu, and Thomas Leudi, "What's next for international chemical companies in China?" *McKinsey Quarterly*, June 2013.

74 Ibid.

data and advanced analytics to reduce the error rate in its sales forecasts from 40 percent to within 10 percent.[75] Although adoption of these tools is still at an early stage in China (and will depend on the continued development of the Internet of Things and big data analytics capabilities), the major producers have strong incentives to move ahead on this front. Given the rapid pace of technology development and the huge potential for increased efficiency, prospects for future adoption appear promising.

But some challenges remain. China's technology landscape remains fragmented, which makes establishing technical standards for interoperability in the Internet of Things more challenging. This forces companies to build proprietary systems from hardware to software rather than crafting specialized functions onto existing platforms.

### E-commerce

As in any other sector, chemical companies can use e-commerce to reach new customers in a cost-effective way, lowering administrative and transaction costs and reducing purchase order mistakes. E-commerce also improves the overall customer experience by offering round-the-clock access and creates a channel for collaboration with customers to improve product design and production ramp-up.

Companies can build their own platforms, as Dow Corning has done with its digital direct channel, Xiameter, which focuses on SME customers and now represents 40 percent of the company's sales.[76] While more than a third of the top 20 global chemical companies have established their own platforms, Shandong Chambroad and Jiangsu Sanfangxiang are the only top 20 Chinese companies to have done so.

Third-party marketplaces charge transaction fees to sellers or buyers; the major Chinese players for chemicals include Alibaba, HC360, and Guangzhou Chemical Exchange Center. While there are successful examples globally (such as Elemica), only seven of the top 20 Chinese chemical companies sell through major third-party marketplaces. By contrast, B2B sales platforms (such as Amazon Supply) purchase from chemical companies and sell to business customers online. But this model has not proven very relevant for mainstream chemical manufacturers in China; the chemicals sold at Amazon Supply are very downstream products (such as disinfectant, adhesive, and paint) for small businesses.

E-commerce has gained only limited traction in this sector for several reasons. First, the chemical industry is primarily a B2B business, and the Chinese market is heavily relationship-driven. Second, few Chinese chemical companies have adopted enterprise resource planning (ERP) software, making the potential cost savings of connecting e-commerce to ERP less significant. Lastly, personnel and sales costs are relatively low in China, which reduces the urgency of streamlining these areas.

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75 SAS customer stories, http://www.sas.com. See also Doug Henschen, "Dow Chemical moves analytics into mainstream," *Information Week*, September 4, 2012.

76 Don Davis, "A chemical manufacturer finds the formula for e-commerce success," *Internet Retailer*, October 30, 2012. See also Mark W. Johnson, Clayton M. Christensen, and Henning Kagermann, "Reinventing your business model," *Harvard Business Review*, December 2008.

But e-commerce is likely to hold greater appeal in the future as chemical companies shift their focus from China's megacities to the small and mid-size cities that are expected to contribute a disproportionate share of future economic growth. E-commerce could become an important channel to reach new customers that were previously prohibitively expensive to serve. Moreover, China's chemical industry is more fragmented along the value chain than its counterparts in developed countries—a situation in which the information transparency provided by e-commerce can prove to be extremely valuable for matching the needs of buyers and suppliers in a cost-effective manner.

### Customized systems based on the Internet of Things

Chemical companies can use Internet applications to customize product offerings for customers, transforming themselves from manufacturers into integrated solutions providers and sharing with their customers the additional value that has been created.

There is huge potential for chemical companies to create value for farmers through precision farming, for instance (see Box 3, "High-tech farming"). Previous McKinsey Global Institute research has estimated that the precise and scientific application of fertilizer and irrigation could increase yields by 10 to 20 percent.[77] Other types of customized offerings include water-treatment solutions for industrial companies. US-based Nalco, for example, has diversified beyond selling chemicals to offering integrated water-treatment services. Its 3D TRASAR technology uses real-time 24/7 monitoring to detect early deterioration in customers' cooling systems and deliver the appropriate chemical response; the result is reduced maintenance, a more precise use of chemicals, lower operating costs, and maximum asset protection.

In addition to capturing external and customer data, the Internet of Things can be deployed internally to optimize manufacturing processes, creating huge value. Advances in sensor technology, networking software, and big data analytics allow companies to track and mine data at a much more granular level to capture productivity improvements. Chemical companies have strong incentives to adopt the Internet of Things for these internal uses, because production is at the heart of their cost structure.

77 *Disruptive technologies: Advances that will transform life, business, and the global economy*, McKinsey Global Institute, May 2013.

### Box 3. High-tech farming

In agriculture, next-generation technologies have the potential to conserve water and raise yields in places where food is in short supply. Precision farming is a farm management concept based on observing, measuring, and responding to varying "hyper-local" conditions. For examples, farmers could locate their precise position in a field and create maps that collect data on variables such as crop yield, terrain features, and moisture levels. The continuous measurement and comparison of these readings will help inform decisions regarding irrigation and fertilizer use. The development of Internet technologies (including the Internet of Things, big data, and cloud computing) has greatly enhanced capabilities to collect, transmit, and process data, thus bringing the promise of precision farming closer to reality.

For example, Norwegian multinational Yara, the world's largest producer of mineral fertilizers, offers a range of fertilizer-management tools to help farmers fine-tune application to suit local conditions, delivering nutrients to crops more effectively, lowering costs, and minimizing adverse effects on the environment.

Some large-scale farms in northeastern China are experimenting with technologies imported from developed markets, but penetration is still low. Under the household contract responsibility system, land is allocated to and operated by a large number of individual farming households, making the area of arable land per farming household very small—while precision farming has a greater impact for large-scale farmers. Moreover, the initial capital investment needed for precision farming can be quite high for individual farmers, and the return might not be obvious to farmers because crop yields are influenced by so many parameters, such as weather.

Despite these hurdles, precision farming could be an important development for China's food security as the nation's population continues to grow and as factors such as climate and soil degradation potentially further decrease arable land per capita. The government encouraged an increase in the average land scale of farmers in the Third Plenum of November 2013. In addition, the development of the Internet of Things was discussed by the Chinese premier in the national "two sessions" legislative meeting in 2010 and has been written into China's 12th Five Year Plan, with precision farming as a key application.

## POTENTIAL IMPACT ON GDP AND EMPLOYMENT

The use of the Internet in the chemical sector could generate incremental GDP of RMB 80 billion to 470 billion, which is equivalent to 3 to 21 percent of the total GDP increase expected in the chemical sector from 2013 to 2025 (Exhibit 13). However, the efficiency gains associated with its adoption may result in the loss of 20,000 to 110,000 jobs in existing activities (or the equivalent of up to 3 percent of sector employment).[78] Four to 27 percent of the sector's overall productivity increase from 2013 to 2025 could be enabled by the Internet.

About 70 percent of the incremental GDP could come from productivity gains—particularly improved demand forecasting and production planning.[79] These levers offer clear, immediate benefits and are usually under the direct control of industry incumbents, which have strong incentives to move forward with them.

78 This employment estimate considers only the impact of the Internet applications described above on the chemical sector and associated value chains. It excludes cross-sector impacts from capital reallocation and incremental demand.

79 To estimate the size of productivity gains, we analyze projections from multiple sources regarding the industry's growth rate, the industry's cost base that may be affected by each lever, the growth rate of adoption, and the cost savings involved. New market potential is based on analyzing projections from multiple sources regarding the industry's future growth rate and growth in penetration rates for individual new products and services. We then subtract growth that may cannibalize offline sales and estimate the value creation associated with this incremental growth. See the appendix for further details and sources.

The remaining incremental GDP could come from new market development stemming from use of the Internet of Things. Although they are unlikely to spur measurable job creation, new markets for customized systems based on real-time monitoring could be significant. Precision farming is a clear Chinese policy priority, as it could help to alleviate pressures on the environment and prevent food shortages. But government support is needed to foster the development of affordable technologies and increase the average land scale of Chinese farmers.

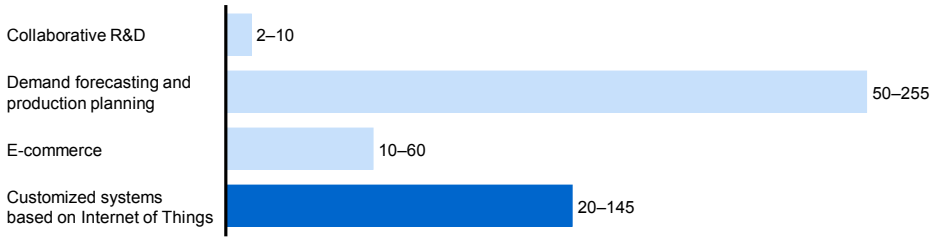
Deploying the Internet of Things for plant monitoring and optimization could enable companies to realize additional GDP of RMB 50 billion to 160 billion, but it would also reduce the need for labor within the sector. However, this process involves the use of internal sensors and the development of a company's own "Intranet" rather the use of the Internet to connect with external data sources. Because of this distinction, we have excluded plant optimization from our overall projections for the impact of the Internet on the sector.

**Exhibit 13**

**By 2025, Internet applications in the chemical sector could contribute up to RMB 470 billion in incremental GDP**

**Potential impact on GDP in 2025**

RMB billion




| | |
|---|---|
| **Total** | **80–470** |
| **% of chemical sector 2013–25 GDP increase** | **3–21%** |

SOURCE: McKinsey Global Institute analysis

## AGENDA FOR MAJOR STAKEHOLDERS

Capturing the full potential impact will require substantial effort from chemical companies and government given the challenges the industry faces in upgrading its portfolio to higher-end specialty products and the current low levels of technology adoption in day-to-day operations. Traditionally, the chemical sector spends less on IT than other industries. Chinese chemical companies lag even further behind than their international peers: PetroChina spends 0.3 percent of its revenue on IT and Sinopec spends 0.1 percent, both well below the global industry average of 1.4 percent.[80] To capture the full potential of the Internet, chemical companies will need to increase their technology investment.

The Internet can profoundly change the way producers collaborate with research partners, suppliers, distributors, and end-users. Manufacturers will be able to connect with partners in real time, and there is unprecedented computing power available to mine this data to optimize decisions and efficiency. These Internet-

80 According to Gartner's *IT metrics: IT spending and staffing report 2011*, IT spending as a share of revenue is 1.4 percent in chemicals vs. 6.0 percent in financial services, 4.7 percent in education, 3.2 percent in health care, and 2.7 percent in industrial manufacturing. Figures for PetroChina and Sinopec from IDC Wallet data, 2012.

enabled collaborations and technologies can reduce costs in R&D, production, supply chains, and marketing and sales, and may open new business lines.

But like other manufacturers, chemical companies will be forced to become more agile and responsive to compete in a fast-changing digital world. Companies will have to adopt and embrace these technologies in a coordinated and integrated way, investing not only in the new technologies themselves but also in talent and capabilities.

Although the market is in the best position to choose the most viable and competitive solutions, the government could foster the environment and infrastructure needed to advance relevant technologies. First and foremost, it can continue to drive the development of the Internet of Things as outlined in the 12th Five Year Plan by sponsoring research and innovation in key areas such as networking, sensors, actuators, automation, and cloud computing. It can also facilitate the establishment of commercial technology standards for interoperability. This will allow companies to collaborate instead of maintaining proprietary systems, which might slow innovation. To encourage the adoption of precision farming, the government can improve essential Internet or mobile technology infrastructure and education in rural areas, and allow capable farmers, investors, and associations to operate larger-scale farms. Additionally, improving regulation of intellectual property protection and data privacy could enable greater use of the Internet for collaborative R&D.

□ □ □

The Internet age is already reshaping China's consumer electronics, automotive, and chemical sectors, and the decade ahead is likely to usher in even more sweeping changes. Cost savings and intensifying competitive pressures will compel more and more companies to adopt Web-based tools for everything from supply chain management to customer service interaction. Just as demand for digital content has skyrocketed in recent years, other fledgling markets within these sectors have the potential to take off rapidly. Companies that can spot new Internet-driven trends among Chinese consumers and innovate quickly will be able to capture enormous value.

# 3. Productivity gains and positive spillovers in finance, real estate, and health care

The Internet is a powerful tool for boosting productivity within most sectors across the economy. But its impact is particularly striking in the sectors that provide society's "infrastructure"—including finance, housing, and health care.

Internet tools can allocate scarce resources more efficiently and address long-standing market gaps. Within finance, the Internet is lowering transaction costs, improving risk management and credit assessment, and giving rise to innovative new platforms. As a result, SMEs can gain better access to capital, and a large population that has long been underserved now has a wider choice of financial products and services. Within real estate, the rise of e-tailing is reshaping demand for commercial space, while the Internet creates pricing transparency and better matching of buyers and sellers. Health-care reform is receiving a boost from Internet innovations such as telemedicine, which connects patients in remote areas with specialists hundreds of miles away.

When these sectors become more transparent and efficient, the ripple effects can be profound. In fact, the spillover effects might exceed the benefits captured by stakeholders within the sectors themselves. A big part of the estimated GDP impact might flow into the hands of consumers—who stand to reap even larger intangible benefits if the Internet fulfills its potential to help China widen access to capital, build more efficient real estate markets, and accelerate health-care reform. Because these industries significantly affect the overall economy, they tend to be heavily regulated. As a result, their ability to capture the Internet's full potential will depend in large measure on government policy.

## Financial services: Serving new retail and business segments with enhanced efficiency

Banking reforms, such as the liberalization of interest rates, have been high on the Chinese government's agenda. Competition within the financial services industry is likely to intensify in the years ahead as deregulation continues and Internet finance plays a larger role, and these dynamics have the potential to erode margins. Financial institutions face a greater imperative to harness Internet technologies throughout their operations to reduce costs, shift their portfolios toward high-margin products, and expand into new markets.

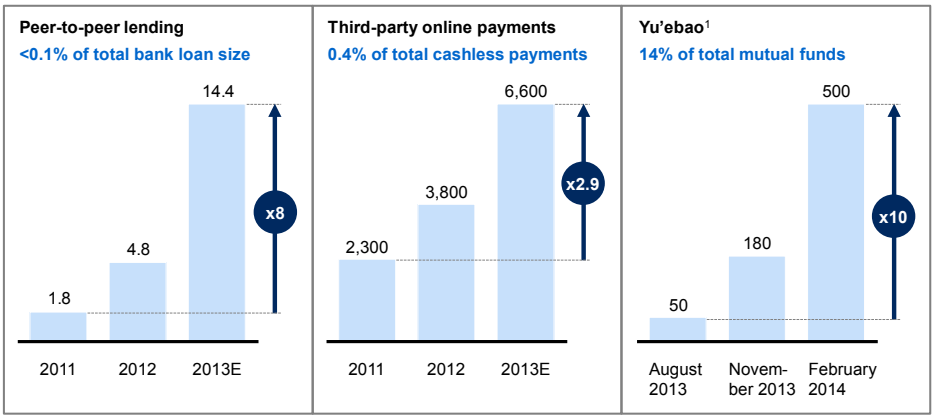
With aggressive moves by major players and the introduction of hit products such as Yu'ebao, 2013 was in many ways the year in which Internet finance began to take off in China. Momentum is continuing to grow: in March 2014, the government announced a pilot program to set up five privately owned banks—and Alibaba and Tencent were among the shortlisted names. The official entry of those technology giants into the banking sector further blurs the boundary between Internet players and financial institutions, and it has the potential to accelerate the financial industry's adoption of new Internet-based technologies

and consumer strategies. The remarkable growth of new platforms and products is rapidly changing the industry landscape (Exhibit 14).

**Exhibit 14**

**Internet finance has grown rapidly and now accounts for a significant share of certain categories within China's financial services sector**

Size of major Internet finance products/platforms
RMB billion




1 Yu'ebao was launched in June 2013.
NOTE: Not to scale.
SOURCE: iResearch; Asset Management Association of China; McKinsey Global Institute analysis

## IMPACT AND ADOPTION

The Internet makes it feasible and cost-effective to meet "long-tail demand," offering a greater variety of more specialized products to more customers. The financial services industry now has greater ability and incentive to process small (and sometimes higher-risk) transactions for markets that have traditionally been underserved. As a result, the Internet has the potential to reshape retail financial activities in particular. Four noteworthy areas of impact are discussed below.

### Wider access to financial products, services, and information

Internet technologies give lenders access to more extensive credit information for better selection of borrowers. The Internet provides a huge number of real-time data points from a large variety of sources (such as social media activity and e-merchant profiles from e-commerce platforms). With the right big data capabilities in place, banks can analyze this information to reduce the risk of non-performing loans, especially in SME and consumer lending. Big data also identifies troubled borrowers sooner, allowing for early intervention.

The integration of alternative information sources can allow lenders to serve customers whose credit histories are limited. Within e-commerce, for example, banks grant loans to e-merchants, while the e-commerce platforms themselves (including JD.com and Suning) in turn provide banks with customer information that allows them to better assess creditworthiness.

Internet players and traditional financial institutions alike have begun to use big data for risk management. Ali Finance, for example, can obtain real-time customer credit ratings by monitoring and analyzing e-merchants' transactions on Alibaba's e-commerce marketplaces. Its current non-performing loan ratio is 0.7 to 1.3 percent, below the banking industry's average for unsecured consumer loans

(1.5 percent) and far below its average for SME lending (over 2 percent).[81] CITIC Bank is also using big data from Union Pay to grant credit to merchants based on their point-of-sale transaction data.[82]

Online channels also reduce the overall cost of serving customers. The combined effect of reduced costs and improved risk management will allow banks to expand their focus from large corporate customers to a wider range of SMEs and retail customers. At present, SMEs account for up to 70 percent of China's GDP but only 55 percent of banks' enterprise loans.[83] The rise of new Internet finance offerings may expand their access to capital.

Among the new business models that have been introduced are the following:

- **P2P lending.** Hundreds of peer-to-peer lending platforms (such as CreditEase, Lufax, and Paipaidai) have launched during the past two years. Although they have posted 180 percent compound annual growth, their outstanding loans in 2013 totaled only RMB 14 billion, which is less than 0.1 percent of total bank lending.[84]

- **Crowdfunding.** Equity-based crowdfunding dominates this segment. Major players Angelcrunch.com and Dajiatou.com raised approximately RMB 220 million and RMB 2.5 million, respectively, via their platforms in 2013.[85] In addition, Shilehui.com, a successful donation-based site, raised more than RMB 70 million from its launch in April 2007 through March 2014.[86] This segment also includes reward-based crowdfunding platforms such as Zhongchou.cn, Demohour.com, and Dreamore.cn; these websites solicit funds for projects and offer the resulting end products as a "return" to investors.

- **Alternative business lending.** Internet-based micro-lending companies such as Ali Finance use their own capital to grant loans to customers. Launched in 2010, Ali Finance had RMB 13 billion in outstanding loans by the first quarter of 2014.[87] Other e-commerce and tech companies such as JD.com and Baidu launched their own micro-lending businesses in late 2013.

To continue growing, traditional financial institutions will need to build their capabilities in big data analytics, while companies from the technology side will need to gain financial risk management expertise. The most critical factor will be the creation of a framework that allows data sharing from different sources while protecting consumers. In addition, a wave of P2P platform bankruptcies since October 2013 illustrates the importance of creating a regulatory framework that can accommodate the growth of Internet finance while mitigating its risks.

81 Alibaba news releases and McKinsey Global Banking Pools database.

82 "Supported by big data, CITIC Bank seeking profit from POS Internet lending," *Security Times*, January 14, 2014.

83 McKinsey Global Banking Pools database.

84 iResearch; McKinsey Global Banking Pools database.

85 Data from company websites.

86 Data from organization website.

87 Alibaba IPO filing with the US Securities and Exchange Commission, June 2014.

### Expanded capital market participation and more efficient allocation of capital

Chinese consumers hold approximately 60 percent of their personal financial assets in deposits (far above the 12 percent held in deposits by US consumers, for instance). But the Internet creates efficiencies with online distribution and services, and as transaction costs fall, so does the minimum investment threshold for wealth management and investment products. Furthermore, abundant online information could improve information transparency and financial literacy, making consumers more informed about their options and less likely to be misled. The result could be capital markets that are not only deeper but also more efficient in allocating capital to high-quality SMEs that have long been underserved.

New consumer products and offerings, which are still in the early stages of development, have begun to emerge. These include the following:

- **Money market funds accessible via online payment accounts.** In June 2013, Alipay launched an investment product called Yu'ebao, which allows customers to move their Alipay account balances into a money market fund managed by Tianhong Asset Management Company Limited. Because Yu'ebao provides high returns (5 to 6 percent in early 2014, far above the approximately 0.4 percent consumers typically earn on bank deposits), has a negligible minimum investment, and offers immediate liquidity, it gained enormous popularity virtually overnight. Its assets under management exceeded RMB 400 billion as of mid-February 2014, making it the largest money market fund in China. Other Internet companies followed suit with similar services, prompting banks to begin offering money market funds in hopes of retaining their customers.

- **Discount brokerages.** Internet players have begun to offer online brokerage services with ultra-low commissions, such as Tencent's 0.02 percent commission rate.

- **Third-party online marketplaces.** A prime example is www.1234567.com.cn (i.e., Tiantian Fund Sales Company Limited), a leading information portal and sales platform for mutual funds. In addition to offering the latest market news and research on specific funds, it allows members with accounts to purchase funds and receive up to a 60 percent discount on transaction fees for some of them.

- **Personal finance tools.** Free value-added services have emerged, such as Wacai, a personal finance mobile app that allows consumers to track and analyze their daily expenses and receive investment product recommendations. By June 2012, Wacai had reached ten million users.[88]

Chinese consumers are eager to invest and diversify, especially if the investment threshold and the perceived risks are low. The infrastructure that would allow them to invest online is fast developing, and online and mobile transactions are becoming popular. However, there is still room for financial institutions to design easy-to-understand products with proper risk disclosure, tailored for online transactions. This trend can support the government's goal of further developing China's capital markets, but only if the potential risks of new product innovation are understood and properly managed.

88 Data from company website.

### Integration of online commerce and payments to offline purchasing experiences

Internet payment platforms (especially third-party platforms run by non-bank institutions) have the potential to increase overall consumption by providing convenience that can fuel additional growth in e-tailing and possibly even offline transactions. E-tailing began with a cash-on-delivery business model, but Internet payment platforms have built trust between consumers and e-merchants. They serve as a sort of escrow service for online transactions: for instance, a consumer makes a payment through Alipay; Alipay notifies the merchant to ship the order; and Alipay releases the funds to the merchant only when the consumer receives the product.

In addition to increasing online and offline consumption, third-party Internet payment systems reduce transaction costs for merchants. Alipay serves as a "soft" point-of-sale system that requires no installation fees and charges very small transaction fees. Other types of systems are also being introduced, such as the WeChat payment app, which allows taxi drivers and customers to complete payments with their smartphones (see Box 4, "China's taxi app wars").

Internet payment platforms have posted a compound annual growth rate of 60 percent over the past five years, but they still account for only 0.4 percent of total cashless payments in China, indicating room for further growth.[89] However, Alipay has already surpassed PayPal in its number of registered users. The combination of a large user base and low average transaction value indicates that third-party Internet payments are serving China's long-tail demand. The fierce battle between Alipay and Tencent's WeChat had implications beyond the competition between these two companies; it further boosted user adoption of third-party Internet payment and mobile payment systems, especially for small, in-person purchases.

The impact of virtual currencies such as Bitcoin and Tencent's Q-coin in the Chinese payment landscape has been limited. Bitcoin is used mainly for speculative investment, while Q-coin is largely reserved for the purchase of virtual goods and value-added services from Tencent.

Consumers are adopting online and mobile transactions quickly, especially with major Internet payment providers aggressively pushing them. Moreover, the traditional payment infrastructure (including the use of credit cards and point-of-sale systems in stores) remains underdeveloped in China, which has created an opening for third-party Internet payments to make rapid gains. (This has similarly been the case in Kenya, where a remarkable 68 percent of adults use text-based mobile money to make payments.[90]) In China, the smartphone is the preferred device for mobile payments—and smartphone penetration, which stood at 54 percent of the installed base in 2013, is growing rapidly. To fully develop this market, however, the industry needs regulatory certainty.

89 Data from iResearch, People's Bank of China.

90 *Lions go digital: The Internet's transformative potential in Africa*, McKinsey Global Institute, November 2013.

### Box 4. China's taxi app wars

Trying to navigate the traffic-clogged streets of China's congested megacities has never been easy—and trying to hail a taxi at busy hours can be next to impossible. Like Uber in the United States, but geared toward licensed taxis rather than independent drivers, Didi and Kuaidi are mobile apps that try to make the market more efficient by allowing passengers to summon the nearest available taxi using their smartphones. Launched in 2012, both applications caught on instantly with China's harried urban residents.

The arrival of Alibaba and Tencent further heated up this battle. Both companies are intent on promoting their respective third-party mobile payment applications, Alipay and WeChat Pay, for online-to-offline payments—and capturing the market for taxi payments became a proxy war. After Alibaba invested in Kuaidi and Tencent invested in Didi, the two giants competed head-to-head on the streets in their efforts to promote Alipay and WeChat Pay. When customers used Kuaidi to hire a taxi and pay via Alipay, or used Didi to hire a taxi and pay via WeChat Pay, both customers and taxi drivers received rebates. An RMB 10 offer for using Didi and WeChat Pay was met by a new offer from Kuaidi and Alipay to return RMB 11 for each ride. The price war went on for several months, until May 2014, when Didi and Kuaidi started to limit the rebate to drivers only. By then, Alipay and WeChat pay had given out RMB 2 billion in total rebates.[1]

The wide adoption of Didi and Kuaidi achieved the desired outcome: greater acceptance of mobile payments. Many taxi drivers and customers have installed e-payment apps on their smartphones and linked their bank accounts to e-payment accounts. But unfortunately for the residents of China's major cities, it has become even harder to hail a taxi on the street the old-fashioned way.

1 Qianyi Zhang, "Didi and Kuaidi's calculation," *Beijing Daily*, May 28, 2014.

### More efficient marketing, distribution, and customer service

Banks, securities firms, and insurance companies have built online channels for distribution, marketing, and customer interactions. This is not only cutting costs but is also allowing these firms to serve previously unreachable customers. The Industrial and Commercial Bank of China estimates that an online transaction entails only one-seventh the cost of a transaction at a branch counter.[91] In other parts of the world, McKinsey has found that if banks fully adopt online channels, they can reduce their branch networks by 30 percent and decrease the number of full-time employees by 50 percent. However, creating online channels requires new investment and then fixed costs, making it equally important for financial institutions to use the Internet to make their traditional channels more efficient.

By 2012, 72 percent of banking transactions in China took place online.[92] Ninety-eight percent of customers at securities firms have registered for online accounts, and 80 percent of customers use their online accounts for transactions.[93] China Merchants Bank, a pioneer in online banking, conducts an even higher share of transactions online (86 percent in 2012).

Both banks and securities firms have strong imperatives to accelerate the adoption of online and mobile channels. Their margins are shrinking due to gradual deregulation and the disruption caused by the rise of Internet players. But if they can harness the Internet themselves, they can tap into markets in smaller cities and underserved segments while reducing costs.

91 Data from 2012 ICBC annual report.

92 Data from iResearch.

93 Data from Securities Association of China.

Consumers can now buy insurance from insurers' websites, online marketplaces such as Taobao, and specialized insurance marketplaces such as Hzins.com and Xyz.cn. Although online channels might increase insurance penetration, the potential is mainly limited to more standardized product categories. In other categories, consumers tend to rely on their personal connection with an agent and typically buy through face-to-face interactions. In 2013, policies purchased online accounted for only 0.5 percent of total gross written insurance premiums in China; the world average is 14 percent.[94] It is likely that insurance companies will increase sales online, but only for policies that are conducive to transparent price comparison (such as auto, accident, travel, term life, and freightage insurance).

Regulations covering areas such as on-site and physical transaction requirements and price controls might need to be revisited in order to allow banks, securities firms, and insurers to fully unleash the potential of online channels while managing the accompanying risks.

## POTENTIAL IMPACT ON GDP AND EMPLOYMENT

By 2025, greater deployment of these Internet applications in the financial sector could create GDP of RMB 500 billion to 1.2 trillion, accounting for 10 to 25 percent of the total GDP increase expected in the financial sector from 2013 to 2025 (Exhibit 15).[95]

Two major types of productivity gains will contribute to more than 80 percent of this impact. Improved risk management capabilities could save RMB 280 billion to 880 billion by reducing non-performing loans,[96] and banks could save up to RMB 230 billion by digitizing their operations, from marketing and distribution to services.[97]

In addition to creating value, the Internet will shift value. As capital markets become more developed, a large share of savings will move from banks to more diverse investment channels. The net interest spread currently enjoyed by banks will be transferred into individual and institutional investors' hands, resulting in a net loss for some financial institutions.

The Internet will also make it possible to improve the allocation of capital, both within lending and in the capital markets—in large part because it is a powerful tool for risk management. This underscores the importance of establishing a fair regulatory framework to ensure open data sharing and robust credit data while

94 Chinese data from iResearch; global data from World insurance report 2014, Capgemini and Efma, February 2014.

95 Baseline projections are from IHS, while the Internet-enabled growth is estimated based on our research through extensive expert interviews. Productivity gains are estimated by assessing the cost base affected, adoption rate, and potential cost savings percentage. New market creation is estimated by assessing the penetration of new offerings, the ratio of incremental market growth vs. the existing market, and the value add of the new market.

96 In China, today's non-performing loan (NPL) rate for SMEs is above 2.6 percent, while the industry average is about 1.8 percent. Yet Internet finance companies using big data to manage lending risks have achieved NPL ratios of less than 1 percent. We assume that by 2025, China's lending industry will be able to improve its capabilities and bring the NPL rate to down to around 1.5 to 1.7 percent.

97 According to iResearch and other data sources, nearly 80 percent of bank activities are already available online. We believe that online banking will further increase its penetration by 10 to 15 percent. Cases from both China and Europe suggest that distribution and service costs could be reduced by 30 to 50 percent.

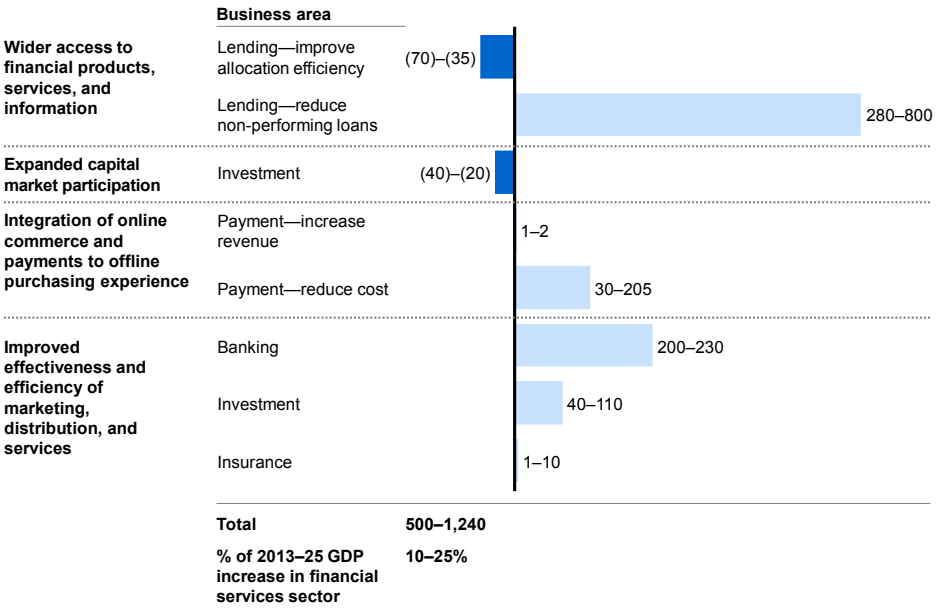
protecting consumers' privacy. Compared with their larger counterparts, small and medium-sized enterprises have more limited access to financing today. As a result, they tend to be efficient with capital, thus producing higher returns on investment than large corporations. But big data (to assess and manage credit risks) and online channels (to reduce transaction costs) can now provide financial institutions with greater capabilities to increase lending to SMEs—and they create favorable economics for doing so. Improved information transparency can also lead to more direct financing of SMEs. In addition, the Internet provides information transparency that can help lenders better differentiate the most competitive companies, forcing SMEs and large companies alike to "up their game" and thus raising the productivity of the overall economy. By 2025, the potential exists for RMB 450 billion to 1.5 trillion of annual GDP increase throughout the economy due to the effects of improved access to capital for SMEs.[98]

**Exhibit 15**

**By 2025, wider adoption of the Internet in financial services could create up to RMB 1.2 trillion in additional GDP**

**Potential impact on GDP in 2025**[1]

RMB billion




1 In other sectors of the economy beyond financial services, capital reallocated to SMEs could create additional GDP of RMB 450 billion–1.5 trillion in 2025 as well as 5 million–11 million jobs.

SOURCE: McKinsey Global Institute analysis

98 We project incremental GDP growth because more capital will flow into small and medium-sized enterprises, and they offer higher returns on capital than large companies. We begin by projecting the growth of China's total pool of available capital (loans, equity, and bonds) from 2013 to 2025, based on IHS and our own analysis. We then assume a higher ratio of capital flowing into SMEs as Internet technologies enable financial institutions to better serve these companies at lower cost. We further assume that this capital will generate higher EBITDA, as has been the pattern in the past with Chinese SMEs. In addition, new capabilities within the financial services sector would not only reallocate capital from the large corporate sector to the SME sector; they would also allow financial institutions to identify the most efficient companies *within* those two sectors. Although we did not assess this impact, it is also an important dynamic. As a result, our upper estimate of RMB 1.5 trillion in impact is conservative.

The Internet can also create direct benefit to consumers by improving their ability to get the best combination of risk and return—and by making fees more transparent and competitive. The compounded impact of reduced intermediary fees over decades would be a huge surplus to consumers, assisting them in preparing for a secure retirement.

As the financial sector integrates these Internet applications more fully into its operations, it can enable 17 to 36 percent of the labor productivity growth expected in the sector from 2013 to 2025. The resulting efficiencies could reduce employment by up to 5 percent, or 370,000 full-time employees, especially in sales and customer service. But the increased availability of financing for smaller enterprises could generate up to five million to 11 million jobs throughout the economy.

## AGENDA FOR MAJOR STAKEHOLDERS

With the advent of disruptive Internet-based business models coinciding with a wave of liberalization in the financial sector, large banks and other incumbents face an era of unprecedented competition. Both forces are likely to shift value from traditional financial institutions to new challengers and to customers. Customers could increasingly move their financial assets from deposits toward other investment products, but they will probably do so via online platforms that produce lower margins. Pricing transparency also increases competition and cuts margins.

But financial institutions that are willing to embrace these changes and stay at the forefront of innovation can capture enormous value. Given how Internet services could change the competitive dynamics, financial institutions will have to act decisively to maximize their online channels and embrace big data to streamline processes, cut costs, and branch out into new market segments.

Where incumbent financial institutions have legacy systems and processes, Internet companies have the advantages of strong technological capabilities and nimble cultures; they could quickly build the financial capabilities required to compete head-to-head with incumbents. In fact, the lack of legacy might allow the Internet players to embrace innovations more quickly than their established competitors.

Companies that originated in the e-commerce sector may own a huge amount of real-time information on the underserved retail and SME segments, which make up at least half of the market. Using that information, companies can build credit profiles based on big data analysis of customers, stock levels, and social network activity. Furthermore, new players could create a significant ripple effect by introducing more competition and new skills to the financial sector and expanding its reach.

Allowing the financial sector to integrate the full potential of the Internet will result in greater and more efficient access to capital. But maximizing the potential economic benefits will hinge on whether China can modernize its regulatory framework and manage the associated risks. Thus far, the government seems to be supportive of Internet finance. Its key elements—such as payment, credit, big data, and cloud computing—are in line with the "financial infrastructure" discussed in the 3rd Plenum of November 2013. And one of the goals that emerged from the most recent "two sessions," China's annual legislative meeting, was to "promote the healthy development of Internet finance and improve financial regulation."

Further government attention is needed in a number of areas, starting with clarifying the regulatory framework to manage the Internet finance sector holistically. Internet finance has increasingly linked areas such as lending, payments, and investment that fall under different regulators. While this development may not necessitate the creation of a new regulatory body, existing regulators will need to collaborate to manage Internet finance effectively. The industry also needs predictability in regulations, including clarification on whether the government will apply the same guidelines covering the financial industry to Internet finance rather than introducing ad hoc restrictions.

The sector is evolving so rapidly that it may be difficult for the government to keep regulations up to date. Policy makers and regulators need to be in the flow of the discussion with industry players, allowing them to keep up with the latest innovations and their associated risks. Internet finance has already introduced new models, such as peer-to-peer lending platforms and money market funds that are linked to Internet payment accounts. The challenge will be for regulators to keep pace with technological change and strike a delicate balance that allows innovation to flourish while mitigating risk. For instance, regulations covering on-site bank account opening and risk assessment, as well as insurance pricing and electronic policies, might need to be revisited.

Managing risks within existing regulatory frameworks would ensure fairness within the broader financial sector and create a level playing field. Laws will be needed to provide certainty in areas such as reserve ratios, the sharing of credit histories, and interest rate regulation. Moreover, cross-subsidies for Internet finance businesses will need to be closely monitored to ensure that they do not hurt competition and thus consumers in the long term.

Shared data is a prerequisite for a robust credit system. The People's Bank of China credit database, which banks already use, could incorporate data from other sources such as local governments and other relevant government agencies, including the State Administration for Industry and Commerce. Other stakeholders, including Internet companies and financial institutions, could contribute to and use this database. While that is one alternative for sharing data, online data need not be consolidated in a single place—but for data to be shared and used to its full potential, clear boundaries need to be defined for privacy protection, and penalties need to be established for fraud. With the concept of My Data, information collected about an individual (or organization) can be given to that individual, who then has transparency and can help correct data as needed.[99] The Ministry of Industry and Information Technology issued

99 *Open data: Unlocking innovation and performance with liquid information*, McKinsey Global Institute, October 2013.

the "Personal Information Protection Provisions of the Telecommunications and Internet Users" in June 2013, but these general guidelines are not yet law and it is not clear if they will apply to every sector. They also emphasize data protection rather than establishing a framework to facilitate data sharing, so further action may be needed.

## Real estate: Moving from bricks to clicks to serve the needs of residents

China's real estate sector, especially the residential segment, has enjoyed strong growth since 1998, powered by multiple factors: continuous reform, rapid urbanization, steadily increasing incomes, relatively loose monetary policies, and a lack of competing investment options. Posting a compound annual growth rate of 26 percent over the past decade, total residential real estate sales reached RMB 6.8 trillion in 2013, accounting for 30 percent of the overall global real estate market and 5 percent of China's total GDP.[100] The market has produced handsome profits for leading firms, which reported more than 20 percent profitability from 2010 to 2013.[101]

But more recently, the market has shown signs of cooling. Sales are likely to slow as regulatory control tightens in response to increasing concerns about asset bubbles and as investors grow cautious in the face of intimidatingly high prices.

This plateau could increase the importance of Internet technologies to the industry. Web-based tools can reduce costs and optimize operations as well as pave the way to new value-added services and growth in adjacent industries. Developers are beginning to recognize that the Internet can allow them to run more sophisticated operations, create stronger customer loyalty, and offer more comprehensive services.

The growth of the Internet is also shifting demand in the non-residential real estate market. E-tailing is revolutionizing the nature of retail space and increasing demand for modern warehouse properties, while the ability to work and collaborate remotely may reduce the need for office space. Companies and investors that not only use the Internet but also are quick to recognize and adapt to Internet-driven market trends will reap the greatest benefits.

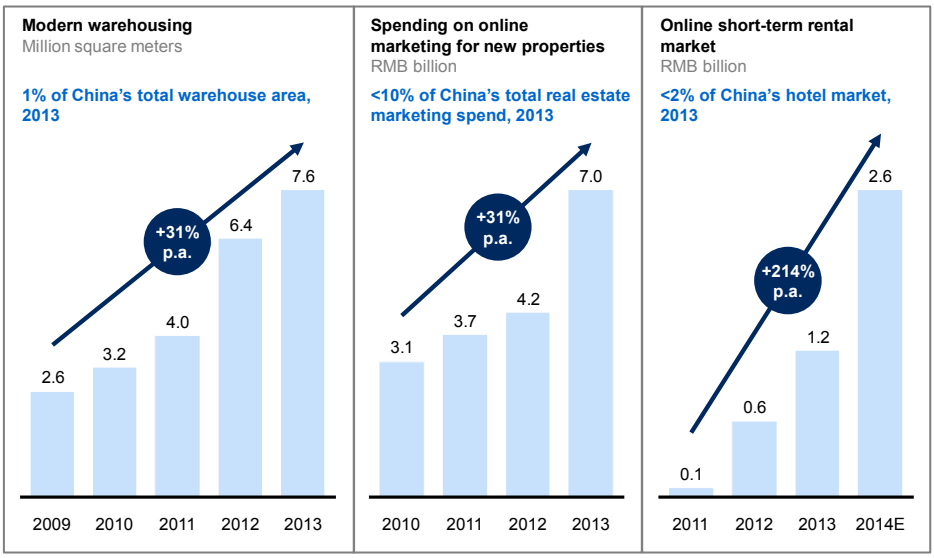
### IMPACT AND ADOPTION

The Internet is likely to reshape China's real estate industry in three major ways: by optimizing processes and lowering costs, by creating new business lines, and by changing the nature of demand in the commercial real estate sector. Some new markets are already growing rapidly (Exhibit 16). Within these three categories, we see more than a dozen potential levers, described below.

100 National Bureau of Statistics; IHS.

101 Annual reports of real estate companies, including Vanke, Poly, Gemdale, and China Merchants Property Development.

**Exhibit 16**
**The Internet is beginning to reshape the real estate sector**




NOTE: Not to scale.
SOURCE: Global Logistic Properties annual report 2012; iResearch; EnfoDesk; Analysys International; McKinsey Global Institute analysis

## Streamlining operations and reducing costs

Internet technologies can enable more efficient land acquisition, sourcing, and marketing and sales, reducing costs for developers, suppliers, property owners, and consumers alike.

### *Online government auctions*

Local governments now have the ability to establish new platforms for land auctions that allow developers to conduct the land acquisition process online. These platforms could reduce transaction costs (such as travel and rent for auction venues), but most important, they can provide transparency.

A few local governments have taken the lead in establishing these platforms. Wuhan, a provincial capital city in central China, for instance, conducted online land auctions that produced RMB 21.5 billion in revenue in 2013; these digital transactions now account for 90 percent of its total local land auction revenue.[102] But a full-scale rollout across China is not likely in the short run, as the small transaction cost savings do not provide an adequate incentive for governments and developers. Future adoption largely depends on whether local governments consider it a priority to make their land sales more transparent.

In addition, Taobao, China's largest C2C e-tailing site, launched an auction platform for foreclosed properties in 2012. Courts register as "stores" and list seized and forfeited properties for sale, allowing buyers to bid on them within a set time frame. This online platform allows courts to list sales for free instead of paying local firms to advertise and organize auctions. They can also reach a much larger buyer base across the nation. This type of tool allows courts to

102 Ying Zou, "Wuhan sold 103 pieces of land online," *China Land and Resources News*, December 2013.

protect the interest of creditors, improve the rate of settled claims, and promote judicial transparency.

Among the early adopters are courts in Zhejiang, an east coast province next to Shanghai. By the end of 2013, 96 percent of its courts had opened a "store" on Taobao; in fact, some 180 courts of about 3,100 nationally had adopted the same practice.[103] The early adopters on Taobao have proven that this use of technology can be successful, and this approach could be widely replicated if governments are determined to push it forward. The conversion rate and the premium obtained through online auctions are 20 percent higher on average than those achieved through traditional auctions.[104] Taobao predicts that 70 to 80 percent of courts nationwide will conduct judicial auctions online in the future.[105]

### *Online sourcing*

E-commerce platforms enable real estate developers, contractors, and hotel chains to purchase construction materials, facilities, equipment, and interior decoration online. They can consolidate volume from buyers, helping especially small and mid-size developers that previously had less bargaining power; this can reduce purchasing costs by anywhere from 5 to 30 percent. At the same time, they allow small but qualified suppliers to connect with new customers at lower cost. In addition to offering products, these platforms could provide one-stop solutions and services, including 3D design visualization tools and supply chain financing.

Online sourcing platforms from SOHO China and Greentown China, two of the top Chinese real estate developers, have taken off in the past two years. Greentown's e-commerce platform was established in 2010 and has been growing rapidly, with RMB 2.5 billion of revenue in 2013. More SMEs are starting to participate in existing platforms, which will lead to more dynamic e-commerce transactions.

### *Online real estate marketing*

Eighty-eight percent of home buyers and tenants in the United States now turn to the Internet to find their properties.[106] The Chinese market is beginning to experience a similar shift, as consumers increasingly search online to find their ideal home. E-commerce platforms such as SouFun.com offer listings and advertisements from developers, agents, and individual owners combined with search engines that filter results based on location, property size, and price range. They also boost traffic by offering real estate market intelligence, mortgage options, and tax and legal advice. The platforms could eventually charge commissions if visitors turn into customers.

Internet technologies and online platforms are helping developers and agents reach target consumers much more easily and quickly, saving up to 40 percent on their marketing costs. In addition, studies have shown that as consumers turn to digital channels, deals can close 25 percent faster.[107] This means that

103 Leilei Dai, "Judicial online action requires related regulation," *Legal Weekly*, January 2014.

104 "187 courts are on Taobao," *Beijing Morning Post*, March 2014.

105 Interview with company representative, April 2014.

106 *Profile of home buyers and sellers and National Association of Realtors member profile*, National Association of Realtors, 2012.

107 *The digital house hunt: Consumer and market trends in real estate*, National Association of Realtors and Google, January 2013.

developers also benefit by selling properties and recovering their investment faster, thus reducing carrying costs.

Some online real estate platforms have begun to build partnerships with the major search engines and portals to gain a deeper understanding of individual visitors in order to make more targeted recommendations. Vanke experimented with location-based advertising in September 2013, using the Tencent mobile app Guangdiantong to push "Vanke Red" property ads to a targeted group of Shenzhen instant messaging (QQ) users. Vanke spent RMB 30,000 on the advertising campaign, which attracted more than 10,000 clicks and yielded more than RMB 4 million in sales and advance deposits.[108] The marketing expenses in this case were 0.75 percent of sales, far below the industry average of 2 to 5 percent.[109]

Online real estate marketing is taking off: SouFun, an NYSE-listed company, and four other leading online real estate platforms captured 3.5 percent of total real estate advertising revenue in 2013.[110] The potential is enormous, considering that US developers now spend more than 60 percent of their advertising budgets online.[111] One concern, however, is that misleading information and fraud could derail this growth; regulation would be instrumental to ensuring an efficient, fair market.

### *Online real estate sales*

While online listing platforms help developers and agents improve marketing efficiency, they could also help individual sellers and buyers, or landlords and tenants, cut out intermediaries and thus save transaction costs. In China, buyers are usually forced to pay 1 to 3 percent commissions for broker-facilitated purchases of existing homes, and renters must pay up to one month's rent as a commission. Online platforms such as SouFun and Anjuke can now match supply and demand without commission fees—but the adoption rate of individual listings is still low. In China, only 3 to 4 percent of online listings for sales of existing homes and 15 to 30 percent of rental listings come from individuals.[112]

As the Internet penetrates more deeply into daily life in China, more individuals will be willing to source deals online without intermediaries, forcing brokers and agents to shift their focus to offering more value-added services. Since real estate purchases are usually big decisions involving a complicated process of appraisal, negotiation, taxation, financing, and ownership transfer, however, professional services will still command value.

### *Online mortgage applications*

Like payments and lending, mortgage application and approval processes are moving online, which could save consumers time and money, as well as helping banks simplify processes, improve efficiency, and reduce costs.

108 "Developers test new marketing methods in the big data era," Sina Leju, March 2014

109 Yuanpeng Yu, *Real estate development cost structure*, Machine Press, 2011.

110 "China new property online marketing market size," EnfoDesk, March 2014.

111 "Benchmarking online real estate listing," NAA, Barclays Capital, PD.

112 Calculation based on website counters of Ganji.com, SouFun.com, and Sina.com.

Most banks have established their own mortgage-application websites. But only 10 to 20 percent of applicants start the process through their bank's website, and they still have to go to branch offices several times.

Online real estate platforms also see the synergy of integrating financial services with other functions. SouFun, for example, has begun to present a wide selection of mortgage offers from different banks and to assist applicants in comparing their options. The company also partners with banks to design new financial products. Its first offering, the JiaTianXia consumer loan, supported by China Construction Bank, is tailored to the SouFun member's spending power and needs and can be used flexibly to pay for renovations, furniture, cars, or vacations.[113]

Although banks and e-commerce players are making active moves, online mortgage applications might not grow rapidly in the short term. A home purchase is one of the biggest decisions in a person's lifetime, and many applicants still prefer to handle it face to face. In addition, housing transaction regulations are complicated and differ across regions, while online mortgage application platforms are usually standardized.

### New business opportunities

The Internet offers a chance for both incumbents and challengers to move into new business lines. There is new potential for collecting transaction information, connecting residents, and finding investors.

#### *Internet-based information services*

In the United States, many information companies track, analyze, and sell real estate–related data to help financial institutions, real estate companies, and individuals better assess the value and risk of properties. For example, Fiserv tracks sales prices and dates for individual properties to develop its home price index. LoopNet offers sales history information for commercial real estate.

A few similar services have launched in China. CRIC, E-House's core business line, is the largest player specializing in real estate information systems, research, and consulting in China. With more than 2,000 employees and more than 5,000 real estate clients, it has branches in 52 cities and provides data on 108 cities. But some Chinese firms are struggling to grow and become profitable. In fact, CRIC was delisted from Nasdaq in 2011 after its performance did not meet investors' expectations.[114]

In the United States, data must be gathered from a range of sources, and the most valuable services rely on comprehensive data sets that are difficult to assemble. The market is even more challenging in China. Correct data might exist only in offline form, and privacy standards have yet to be defined. Moreover, information providers are still experimenting with ways to monetize their data, since insurance companies, banks, individuals, and other potential buyers have not yet developed the capabilities to use and assign value to the data.

113 "E-commerce 5.0," SouFun news, November 2013.

114 CRIC website.

*Internet-based community services*

Developers and property management companies can build online communities to serve several purposes. These include connecting residents through social networks, forums, or chat groups; managing regular administrative and maintenance work (such as garbage removal and repairs); offering value-added services such as housework, gardening, dry cleaning, and elder care; and collecting residents' activity-based data to develop consumer insights. Developers and property management companies can use these networks to charge commission fees and improve customer satisfaction and loyalty.

A few companies, such as Fantasia and Vanke, have rolled out these types of community service platforms. Fantasia's first value-added service was ordering and delivering bottled water for residents. Now it has developed a comprehensive community mobile app called Colour Life, which integrates shopping, dining, housing, transportation, entertainment, travel, and other services with push updates of event information. It also includes an e-card issued in cooperation with China Everbright Bank that can be used for security access and parking and as a prepaid card for online and offline shopping. By using the app, customers can accumulate points for discounted property management fees. Vanke tested the waters with its ZhuZhe'er app, which allows residents to receive important community messages, interact with neighbors, and search nearby shopping and dining options. Vanke also uses apps to coordinate its property management staff and streamline operations.

Currently, these platforms cover only 1 to 2 percent of all the communities in China, but wider adoption is highly likely. Developers used to make one-time profits from property sales and enjoy high margins, but now they have to seek new revenue sources to make up for declining profitability. Consumers are becoming more Internet-savvy, and technology infrastructure is improving, which can smooth the way for adoption.

But expanding into this type of new market will demand vigilant protection of residents' privacy to ensure trust, especially because the online information can be linked to users' physical locations. Already there have been cases of mishandling private information. (One property management company in Shenzhen signed a contract with a bank to issue a community access card with credit card functions. Without notifying residents, the property management company provided the bank with their personal information—and residents were furious when they found the credit cards in their mailboxes. Some credit cards were lost in transit, opening the door to fraud.[115]) Players such as Fantasia have begun to invest in data protection technologies.[116]

*Crowdfunding and customized real estate development*

Crowdfunding platforms allow consumers to invest in residential and non-residential development projects and have a say in property design. This model is just being tested in the United States; Realty Mogul, for instance, was founded in March 2013, and the investment grew 20-fold in half a year. However, real estate crowdfunding is very limited in China. The first project was an apartment

115 Langran Liang, "Huilong Yuan's property management company discloses residents' information without authorization," *Southern Metropolis Daily*, May 2008.

116 Jiyong Hou, "Developers' fantasy over big data: Four things about community service," *21st Century Business Herald*, June 2013.

development initiated by Zhili Yin, secretary general of the Zhongguancun Private Equity & Venture Capital Association, in March 2014 on WeChat Moment (a social media function). In just a month, he gathered more than 200 potential investors and approved 100 of them to purchase residential property in Hebei Province. They each paid a RMB 100 deposit to be added to a WeChat group to discuss the design, layout, and price of the apartments.[117] The apartments are expected to come in below market price.

Crowdfunding's impact in China is unclear, and regulations could make or break it. It may be subject to licensing requirements, and many licenses, such as the land acquisition license, are issued exclusively to developers. Regulators could also determine that crowdfunding blurs the boundaries of illegal fund raising. In addition, investors' property rights need to be protected, and related regulations are yet to be established. The project described above is testing a Groupon-type model and a limited partnership company model to see which works better within China's current legal framework.

### Shifts in commercial real estate demand

The Internet is changing the landscape of commercial real estate, and developers have to adapt very quickly to the new digital era, which is affecting demand in different segments of the market.

#### *Increasing demand for modern logistics*

The growth rate of China's e-tailing market in the past decade is among the highest in the world, which in turn has led to enormous need for modern warehousing and logistics.[118] In China, only 1 to 2 percent of all warehouses in the market are equipped with modern, state-of-the-art logistics.[119] But e-tailers usually have very specific requirements for efficiency, which is increasing demand for properties with automated systems. Modern e-tailing warehouses are also more attractive from a policy standpoint; they create higher value added and require sorting machinery and other equipment that can add 10 to 15 percent to construction costs.[120] Governments might be less hesitant to turn land over to logistics use because these modern warehouses will spur associated industries and generate more investment and tax revenue than traditional warehouses.

#### *Growth in online retailing*

Retail developers are feeling increasing pressure from e-commerce. The hypermarket concept is becoming less popular, since consumers can easily compare all kinds of products and brands with just several clicks online. Commercial developers are responding by adapting the size, location, and business mix of physical shopping centers to become more experience-oriented.

As e-tailing continues to take off, offline retail sales are being squeezed. Malls attract fewer tenants, and there is downward pressure on rents. Globally, some large retailers are reconfiguring local stores to serve as sorting centers and showrooms. One survey found that retailers expect 42 percent of their sales to

117 Leilei Dai, "Dispute over China's first case of real estate crowdfunding," *Legal Weekly*, April 2014 .

118 *China's e-tail revolution: Online shopping as a catalyst for growth*, McKinsey Global Institute, March 2013.

119 McKinsey analysis, CBRE, DTE data analysis; JLL report.

120 *E-commerce in China: Online is the new black*, Jones Lang LaSalle, September 2013.

come from online, mobile, and social channels by 2017.[121] China's offline retail real estate market is also feeling these trends. The low-end mass market segment is the most vulnerable and is already suffering from low foot traffic and high vacancy rates.

Dedicating more space for restaurants, entertainment, and services has become the new rule of thumb for retail developers. The Shanghai K11 Art Mall and Beijing's Parkview Green are prime examples of malls serving as social centers. Traditionally, retail space can occupy 70 to 80 percent or even more of typical shopping malls. However, Parkview Green allocates more than 30 percent of store space to restaurants and hosts significant art shows.[122] K11 goes even further: 45 percent of its space is devoted to restaurants, entertainment, and other complementary services.[123]

### *Increase in remote working*

The Internet enables employees to work from home, allowing companies to take advantage of reduced requirements for office space. This trend could one day make central business districts less congested and expensive. According to a recent survey of 1,900 IT managers from 19 countries, 89 percent of organizations globally expect to offer mobile work options by 2020. The same survey revealed that in China, some 21 percent of employees could already work remotely when needed, and 73 percent of organizations have partial mobile working support. The need for office space is expected to shrink by about 20 percent by 2020.[124] Remote working also allows companies to avoid heavy traffic, high rents, and the high living cost in central business districts.

Since the share of knowledge workers in China's labor force is increasing, remote working is becoming more relevant. The main hurdle to further adoption rests with companies themselves. While keen to save on rent, many still have concerns over the productivity of remote employees and favor face-to-face interaction. In the United States, Yahoo and Best Buy ended their remote working programs in 2013.

### *Internet-enabled short-term rentals*

Online platforms such as Airbnb allow hosts to list space in their homes for short-term visitors or tenants. The platforms profit by charging 3 to 12 percent commission fees from hosts and guests. Although hotels are wary of this competition, one study indicated that the local hotel market could take only a 0.05 percent hit in total revenue for every 1 percent increase in Airbnb listings.[125] The main threat from these models is to mid- and low-end hostels.

121 *Retail vision survey*, Motorola Solutions, May 2012.

122 Haifei Guo, "Parkview Green: Dis-capitalized art mall," *The Economics Observer*, August 2013.

123 Ibid.

124 *Workplace of the future*, Citrix, September 2012.

125 Georgios Zervas, Davide Proserpio, and John W. Byers, *The rise of the sharing economy: Estimating the impact of Airbnb on the hotel industry*, Boston University School of Management, research paper series number 2013–16, 2013.

Large platforms such as Airbnb have grown tremendously around the globe, especially in the United States and Europe, where they are already equivalent in size to 4 to 9 percent of the total hotel market.[126] In China, the online short-term leasing market size is still less than 1.3 percent of the size of the hotel market. Short-term leasing platforms were launched in 2011, and currently fewer than ten key names are covering ten to 20 cities (but with thousands of hosts).

However, legal and regulatory concerns over short-term rentals have arisen in both the United States and China. Airbnb has come under scrutiny because hosts often fail to pay taxes, and a large number are suspected of operating illegal hotel services in areas where zoning does not allow commercial activity.[127] In China, long-term rentals require temporary residence permits, but there is currently no regulatory control over short-term rentals. The transactions also take place under the table, which could cause tax losses to the government.[128]

These platforms may face even greater hurdles in China than elsewhere. In fact, the first company, Airizu, already exited the market after running out of funds. In addition, hosting strangers for RMB 300 a night may have limited appeal to Chinese residents. VRBO and other more upscale platforms have been successful elsewhere around the globe, but affluent Chinese residents who own multiple properties typically do not need extra cash and find short-term leasing too troublesome.

## POTENTIAL IMPACT ON GDP AND EMPLOYMENT

The growing use of Internet technologies in real estate could decrease GDP by RMB 120 billion or generate incremental GDP growth of up to RMB 240 billion from 2013 to 2025, depending on the extent of Internet adoption and the scale of Internet-driven shifts in commercial demand (Exhibit 17).[129] This is equivalent to a GDP loss of 3 percent or a 6 percent increase in the sector's projected GDP growth during this period. The Internet can also enable 7 to 23 percent of its productivity growth. As a result of these efficiencies, up to 1.5 million jobs (or the equivalent of up to 8 percent of sector employment) could be lost in the real estate sector itself and in its associated value chain activities such as construction.[130]

GDP in commercial real estate could decrease by up to RMB 300 billion. However, some vacated commercial spaces could be reconfigured for new purposes, becoming entertainment venues or health-care facilities. New areas of demand, from warehouses with modern logistics to short-term leasing options, could create RMB 23 billion to 82 billion in additional GDP.

126 *Vacation rental market trends*, Homeaway, 2013.

127 Andrea Peterson, "Airbnb is facing off against New York's Attorney General. Here's why," *Washington Post*, April 22, 2014.

128 Jian Han, "Second session of the CPPCC city government sidelights," *Weihai Daily*, January 2013.

129 Baseline projections are from IHS, while the Internet-enabled growth is estimated based on our research through extensive expert interviews. Productivity gains are estimated by assessing the cost base affected, adoption rate, and potential cost savings percentage. New market creation is estimated by assessing the penetration of new offerings, the ratio of incremental market growth vs. the existing market, and the value add of the new market.

130 This employment estimate considers only the impact of the Internet applications described above on the real estate sector and its associated value chains. It excludes cross-sector impacts from capital reallocation and incremental demand.

The Internet will also cause value shifts. More transparent real estate data and information will make for better-informed buyers and renters and will reduce price premiums based on information asymmetries. However, if the real estate markets remain concentrated and highly regulated, developers will likely retain any cost savings they achieve; their productivity gains are unlikely to translate into lower property prices for consumers or higher margins for suppliers.

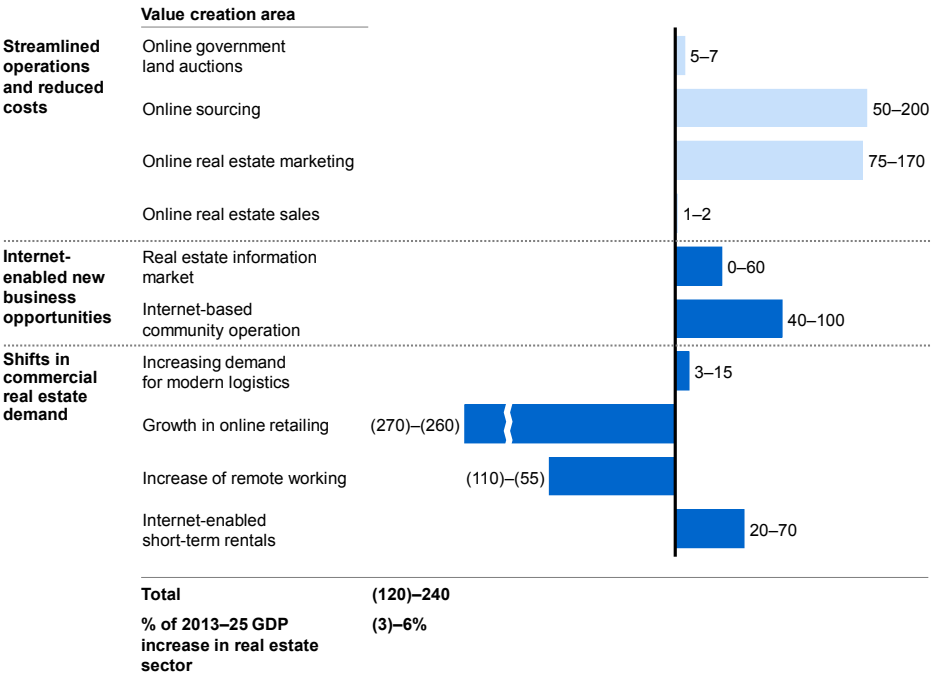
Beyond the simple dollar value, use of the Internet in the real estate sector has broader potential for quality-of-life improvements. Real estate e-commerce platforms speed sales for sellers and allow buyers to find homes that meet their needs much more easily. Internet-based community networks could deliver convenient services directly to residents' doorsteps. We did not quantify the GDP impact of crowdfunding, but it could give consumers a new avenue for investment and a new way to participate in the design of big projects.

**Exhibit 17**

**Internet applications in the real estate sector could contribute up to RMB 240 billion in GDP by 2025**

**Potential impact on GDP in 2025**[1]

RMB billion




SOURCE: McKinsey Global Institute analysis

## AGENDA FOR MAJOR STAKEHOLDERS

The Internet is rapidly transforming the sector, and companies that adapt swiftly and find innovative uses for Web-based tools are likely to gain a competitive advantage. Developers and realtors have considerable opportunities for cost savings and new business lines, and they have strong incentives to accelerate technology adoption. The market for value-added services, while still fragmented, could undergo rapid growth. Developers and property management companies are well positioned to expand into new services, building on the strength of their offline presence, but new challengers (including companies from the technology sector and adjacent industries) could seize the opportunities if incumbents do not act quickly.

The quantifiable impact of the Internet on real estate is not as large as in other sectors, but the potential for moving away from central business districts and for enabling better price discovery could have significant social impact. The government could play a critical role in creating the right foundations, incorporating forward-looking urban planning, and encouraging modern logistics and more efficient use of land.

The government also has a stake in integrating the Internet more fully into real estate in terms of creating a registration system that could lead to imposing property taxes for the first time. Creating a nationally connected, comprehensive real estate information system and moving away from fragmented paper-based record-keeping is a necessary precursor and could yield other types of administrative benefits.[131] Hu Cunzhi, the vice minister of land and resources, has announced that real estate registration regulation is expected in 2014. A property tax pilot program was launched in 2011 in Shanghai and Chongqing, two of China's largest metropolitan areas, and is expected to be scaled up in the near future. But much groundwork remains in aligning the departments and local governments involved. The Ministry of Housing began building a housing information network in late 2010, but by mid-2013, only 60 of the projected 500 cities were connected.[132] The impact of imposing a property tax remains to be seen, but policy makers expect that it could cool off an overheated market and provide a reliable source of revenue to local governments, thus lowering their reliance on selling land.

In addition, the sector's adoption of the Internet depends on having clear regulation and policy support in a number of areas. Local courts would need to become more willing to use new online tools that increase efficiency and transparency. A regulatory structure is needed to facilitate data collection and usage, while safeguarding consumers in all of these new markets, including protecting their privacy and their data, preventing fraud, and providing clear mechanisms for dispute resolution. Real estate crowdfunding is still in the embryonic stage, but clear regulation could lead to healthier growth and avoid potential abuse.

131 Zhenhua Ma, "Wuhan real estate archive digitalization is close to completion," *Changjiang Daily*, September 2013.

132 Jintie Qu, "Housing information network can be expected in six years," *Fenghuang Real Estate*, March 2014.

## Health care: Expanding access while lowering costs

As the Chinese economy has grown, the country's health-care sector has consistently represented around 5 percent of total GDP. By 2020, the country aims to increase health-care spending to 6.5 to 7 percent of GDP.[133] The government has released a series of ambitious reform plans since 2009, when it announced its intention to invest around RMB 770 billion in health care.[134] Four years later, China has spent more than RMB 2.3 trillion, with about RMB 620 billion going toward insurance, public health, public hospital reform, and development of community health centers (CHCs).[135] These actions indicate the government's determination to improve the quality of health care.

The sector faces multiple challenges, especially as the population ages. Greater wealth also leads to a higher incidence of chronic disease, which brings a substantial economic burden. Resources are not well allocated between urban and rural regions, and between hospitals and CHCs. The provincial hospital bed occupancy rate is 120 percent, compared with 25 percent in township hospitals and only 18 percent in private hospitals.[136] Highly publicized incidents of hospital violence epitomize the deterioration of the physician-patient relationship. Waiting in line for several hours but meeting with a physician for only three to five minutes has become the norm for patients. Overtreatment and overprescription are serious issues.[137]

The Internet can play a major role in accelerating reform and containing costs. To address imbalances in access to care, the system could take advantage of the regional health information network model, which enables three-tier referral.[138] Increased use of remote monitoring could save patients many trips to the hospital. Physician-patient relationships could benefit from time-saving online appointment systems and from online rating and review systems. Implementation of the "clinical pathway" approach and wider adoption of clinical decision support systems could reduce patients' expenditures per hospital visit. The Internet is already being widely adopted by practitioners: as of 2011, most physicians were aware of microblogging, and more than 50 percent of them were Weibo users.[139] Pharmaceutical companies and medical device companies are increasingly using Internet tools to target patient groups. If the sector can continue to build on this early momentum, rolling out reform will be easier.

133 *Health China 2020*, Ministry of Health, August 2012.

134 The plans, all released by the State Council of China, include *2009–2011 Embodiments of deepening health reforms*, April 2009; *Opinion on consolidating basic medicine system*, February 2013; *Five foci of healthcare reform*, April 2010; and the *12th Five Year Plan of healthcare reform*, March 2012.

135 Yanzhong Huang, "Chinese healthcare reform: Where did the USD 317 billion go?" *Forbes China*, March 2014.

136 Yali Liu, "Health reform progress and effect are not obvious. What are the keys for reform in the future?" *Beijing Business Today, 2014*.

137 Yongbin Li et al., "Overprescribing in China, driven by financial incentives, results in very high use of antibiotics, injections, and corticosteroids," *Health Affairs*, volume 31, number 5, May 2012.

138 Patients are encouraged to see a general practitioner for diagnosis before being referred to a specialist if necessary.

139 McKinsey/DXY (www.dxy.cn) 2012 Physician Survey, June 2011.

## IMPACT AND ADOPTION

Recent plans to reform health care have emphasized the necessity of promoting IT adoption and establishing a connected network of medical records, public health information, insurance information, and drug supply management information. The Internet will be an important facilitator in the four key areas described below.

### Public health management and services

Public health management is critical for China, where recognition of the value of prevention is growing. By 2050, 30 percent of the population will be elderly.[140] At the same time, chronic diseases are becoming more prevalent, affecting some 260 million people in 2012.[141] However, there is evidence that with the right education, social support, and healthy environments, people can and will take charge of their health.[142] Two important Internet-based tools could help this effort.

#### *Electronic health records*

The electronic health record (EHR) is a standardized method of documenting lifetime health information for an individual. Ministry of Health guidelines issued in 2009 call for an EHR to consist of three elements: life stage, disease and health problems, and health-related activities such as prevention, treatment, and recovery.[143] The EHR includes electronic medical record information, which medical institutions use to store clinical practice records and health service records.

Compared with paper-based records for public health management, the EHR system is both more convenient and more efficient. Individuals can review their own records to monitor their status and can disclose their records to various health-care providers for a more holistic and consistent approach to their treatment. Real-time health records can also facilitate early disease detection among high-risk populations. Experts forecast that myocardial infarctions can be predicted and prevented in nine out of ten patients.[144] In addition, complete health records help local government and agencies gather accurate data, which enables the design of more effective policy responses and interventions.

The United States has aggressively promoted the adoption of EHR through funding infusions and regulatory requirements. As of July 2013, 67 percent of US hospitals had achieved the first stage of meaningful use, and nearly all hospitals and physicians had voluntarily participated in some way. The participation rate had been in the single digits since late 2010, but it rose dramatically thanks to a Medicare and Medicaid incentive program.[145]

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140 *Social pension service system development plan, 2011–2015*, State Council of China, December 2011.

141 *China's chronic disease prevention and control plan, 2012–2015*, China Food and Drug Administration, May 2012.

142 *The power of prevention: Chronic disease … the public health challenge of the 21st century*, National Center for Chronic Disease Prevention and Health Promotion, US Centers for Disease Control and Prevention, 2009.

143 *Basic framework and data standard for health profile*, China Ministry of Health, May 2009.

144 Dayi Hu, "Build a healthy cardiovascular defense: Phone number for healthy nation," *People's Military Medical Press*, January 2009.

145 Jennifer King and Julia Adler-Milstein, "Hospital progress to meaningful use: Status update," *Health Affairs* Blog, October 2013.

China faces an uphill battle with regard to EHR adoption that will involve tackling infrastructure, technical, financial, and institutional challenges. Penetration of hospital information system technology is still low in lower-tier hospitals, CHCs, and clinics in rural areas. And even in large cities and Class 3 hospitals,[146] information remains scattered among different sources (government departments, social and commercial insurance institutions, hospitals, and CHCs, to name a few), stored in different formats, and processed by different software. To build a complete EHR system, technology standards and regulations on data sharing need to be in place.

### *Fitness apps and wearable devices*

The market for mobile health services reached RMB 2 billion in 2013, with annual growth of 50 to 80 percent predicted in the next three years. The wearable device market is growing at an even faster pace and is projected to reach RMB 5 billion by 2017.[147]

Apps and devices help increase users' health awareness and promote a healthy lifestyle (see Box 5, "Baidu moves health care into the cloud"). They enable remote monitoring and push notifications in case of emergency. In 2013, the number of Nike+ users in China grew 130 percent, and Nike+ app registration increased more than 350 percent, from 0.57 million to 2.58 million.[148] Similar apps and devices include alert and reward systems that encourage movement (for example, by counting footsteps). In addition, users share movement information within their social circles, and the competitiveness of the resulting "games" can promote behavior change.

Although more than 2,000 health-related apps are available, only 2.9 percent of mobile users in China who responded to a recent survey said they have installed one.[149] But awareness will increase use; in fact, 88.6 percent of respondents to the same survey expressed willingness to try out health-care mobile services. Consumers and experts agree that the quality of both hardware and software must improve to deliver meaningful user experiences; the prospects for future adoption—and for significant changes in behaviors and lifestyle through long-term use—depend on it. Only a few leading players have developed clear business models and differentiated value propositions, while many apps and devices are copycats providing low-quality services.

146 China designates hospitals using a three-class system. Class 3 institutions have more than 500 beds and serve as medical hubs of multiple regions. Class 2 hospitals have 100 to 500 beds and are usually affiliated with medium-sized cities, counties, or districts. Class 1 hospitals have fewer than 100 beds and are typically located in townships.

147 *China mobile health market research annual report (2012–2013)*, iiMedia Research Group, April 2013.

148 Meng Zhou, "Wearable devices: Join the party or watch," *China Sports News*, May 2014.

149 *China mobile health market research annual report (2012–2013)*, iiMedia Research Group, April 2013.

### Box 5. Baidu moves health care into the cloud

DuLife is Baidu's new brand, founded in December 2013 to focus on intelligent portable devices. The company's first few products are all health care–related. They include the Boom Band health monitor, MUMU blood pressure meter, and Latin body fat meter. The products collect health statistics such as movement, sleep, blood pressure, and blood fat, and then transmit data to the cloud using mobile apps. Through data aggregation and analysis, DuLife provides users with health reports as well as nutritional guidance, exercise instruction, and tips for improving sleep.

These products are moderately priced to encourage adoption. The data gathered could be mined to generate consumer insights for business partners. For example, shoe companies could employ sensors to learn about customers' travel routes and consumption behavior.

## Accessibility of medical resources

Health care in China is structurally unbalanced. Not only are 80 percent of resources concentrated in urban areas, but patients often go to major hospitals for minor issues rather than visiting clinics or family physicians. Physicians also tend to remain at one hospital, and the best medical students go to the top hospitals for exposure and training. This creates a lack of confidence in the quality of care at community clinics, and patients' reluctance to use CHCs creates huge waste and strains on major hospitals. Internet services could be a powerful tool in China's efforts to address these issues.

### *Regional health information networks*

Although Class 3 hospitals account for less than 2 percent of all health-care institutions, they handled 37 percent of outpatient visits in 2012.[150] Every day, 700,000 patients from other provinces come to Beijing for medical treatment, for instance. Some 70 percent of patients in Class 3 hospitals could have received proper care in CHCs or smaller hospitals; 30 percent come to hospitals just to purchase medicine.[151] Regional health information networks (RHINs) are designed to help alleviate these problems by connecting Class 3 hospitals with CHCs and other health institutions, enabling two-way referrals, and coordinating diagnoses.

On top of balancing resources, RHINs improve treatment quality by providing consistent health-care records, which in turn reduce redundant diagnoses and treatment. Easier and faster storage and transmission of patient information would make health-care institutions more efficient.

RHINs originated in 2008; the first networks were associated with top hospitals in Beijing, Shanghai, and Sichuan. The Shanghai Shenkang RHIN is the pioneer in the field, covering 38 municipal hospitals, 6,000 outpatient physician workstations, 5,100 in-patient workstations, and 2,900 testing centers. It has established health records for 39 million people. Since its inception, the Shanghai Shenkang RHIN has helped patients save RMB 80 million. Beijing Chao-Yang Hospital formed its own RHIN with three other hospitals and three CHCs. In 2012, through two-way referrals, 700 patients were transferred to lower-tier hospitals,

150 Ministry of Health, *China health statistical yearbook*, 2012.

151 Caizhou Yue, "RHIN: Hardship covered by rosy pictures," *China Consumer News*, May 2014.

and the average stay at the flagship hospital was reduced to 8.4 days from 9.2 days.[152]

At a health conference in 2013, Zhu Chen, then the minister of health, stressed RHINs as the main goal of the next stage of reform.[153] Beijing has already launched multiple RHINs in districts across the city. Nationally, large cities such as Guangzhou, Chengdu, and Wuhan as well as more than 20 prefecture-level cities are establishing more RHINs, which will cover 100 million people.

RHINs are a promising approach for meeting China's goals of expanding access to quality care and making the overall health-care system more efficient (see Box 6, "The Minhang RHIN: A success story made possible by technology"). A number of complex policy and logistical issues will have to be resolved in order to make this a reality. For example, because hospitals are self-financing, they are not motivated to share patients' information because they may lose business and revenue. Building trust and changing habits among patients will also be crucial. Health insurance rules may need to be updated, as some medicines are available and covered only in higher-tier hospitals. At its core, however, the entire RHIN concept is premised on getting stakeholders to share data and resources—and the Internet is a critical tool for making this feasible, efficient, and cost-effective. Policy makers will have to ensure that the infrastructure, incentives, and safeguards are in place to facilitate a robust data-sharing system that protects patient privacy.

### Box 6. The Minhang RHIN: A success story made possible by technology

The Minhang district of Shanghai has one of the nation's first RHINs. Its progress has impressed many health-care providers—and Internet technology is at the root of many of its innovations.

Almost all residents of Minhang have received an e-health card, which carries their health-care–related information and allows physicians access to their medical records. A resident can use this e-card to make an appointment online, check in, receive and record a diagnosis, and then pay. After a visit, the patient can make the next appointment with the same doctor, something the previous system did not permit. Patients who need to see a doctor at a different hospital can be transferred directly. Throughout China, patients crowd Class 3 hospitals, but by 2012, 95 percent of first consultations in Minhang took place at CHCs.

RHINs also help hospitals and government officials monitor physician behavior, allowing them to scrutinize all prescriptions and prices within the system. Technology can identify irregularities, such as overdoses, and can allow hospitals and physicians to be compensated based on activity rather than on total treatment revenue. Under the new system, medicines are kept in an automated warehouse with more than 700 small pipelines. After a patient swipes an e-health card, the system automatically delivers the medicines prescribed to the patient to a box in front of the patient. This can save hospitals almost half the expense of pharmacists' labor, improve accuracy and efficiency, and reduce patient waiting time. In addition, the system records providers' activity information, such as times of visits to communities, number of patients received, and patients' satisfaction.

152 Longjie Ye and Guogen Sun, "Shanghai RHIN enables real time-data sharing and helps patients to save costs," *Health News*, March 2014.

153 Yajie Wang, "RHIN is the key to the next stage of healthcare reform," *National Business Daily*, March 2013.

### *Hospital ratings and reviews*

Hospital and physician rating and review platforms publish information about practices and treatment results, and they allow patients to rate their clinical experiences and leave feedback. These websites save patients search time and reduce the cost of seeing a physician who is not best suited to a particular case. They also push health-care providers to improve treatment quality and patient satisfaction.

These platforms have become widely used tools in other countries, where they may combine objective data on pricing and treatment outcomes with patient reviews. In the United Kingdom, for instance, the National Health Service's public website, NHS Choices, supplies comparative data and prescribing data for individual primary care practices and offers anonymous patient data to allow scrutiny of clinical teams. It also allows patients to rate and review clinicians, services, and health-care facilities. NHS Choices is Europe's most popular health website and the United Kingdom's third-biggest government website—and its traffic is continuing to grow. The site now receives more than 27 million visits per month. In 2012, it published more than 32,000 user reviews, bringing the total number on the site to almost 95,000.[154]

A recent McKinsey patient survey about China's hospitals revealed that 17 percent of patients use the Internet as a source of information to select a hospital, and among consumers under the age of 25, that share is 28 percent. Apps and websites such as Dianping.com and Aibang.com list hundreds and even thousands of health-care providers.

In more advanced versions of review platforms, users can compare treatment prices, which helps them find the best value for their money. In 2014, China's government announced that non-public hospitals could set prices and operate under market mechanisms, which will increase the value of these price comparisons.[155]

However, the ratings and reviews on these websites are not organized, scrutinized, or complete, which limits their usefulness. To increase the effectiveness of the information, either a third party or the government needs to take the lead in standardizing these platforms to ensure information quality. In fact, third-party players such as Haodaifu are already taking steps to ensure comment quality by calling patients to verify their identities and appointment details.

### *Online appointment systems*

Chinese patients are used to going to the hospital directly and paying RMB 4 to 20 for an appointment with a doctor; then they receive a number and wait in line to obtain a diagnosis. Waits are usually long, and patients sometimes feel lucky just to get an appointment. To beat long lines, many go to hospitals very early in the morning—or the night before—to wait for the hospital to open, hoping to get a low number. Online appointment management could make this process much more convenient and painless.

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154 *NHS annual report*, 2012.

155 *Notice on the non-public sector health care issues related to the implementation of market-regulated prices*, National Development and Reform Commission, April 2013.

In the United States, ZocDoc, a physician appointment app, attracts five million users every month. EMIS, a UK vendor whose Patient Access online service enables patients to book and cancel appointments, renew prescriptions, and more, reportedly improves hospital productivity by reducing administrative burden and leaving more time for patient care.

Online appointment systems do not automatically solve the problems surrounding the allocation of health-care resources in China. Appointments with top doctors and in high-grade hospitals remain hard to come by. Higher-tier hospitals are the least motivated to move their activities online: they release only 20 to 30 percent of their total slots to online platforms, and most of the slots are not the most desirable for patients. Of the available slots, only 12 to 40 percent were taken on average. But such platforms do create transparency for many patients, saving them the time and inconvenience of queuing. The government can encourage hospitals to adopt more modern channels (not only online channels) for appointment management, thereby showing more respect for patients. Some experts worry that online appointment systems will deprive would-be patients who are not comfortable with the Internet of access to care. Developing a comprehensive appointment system that incorporates multiple channels, such as call centers, CHCs, and more, should be encouraged.

### *Telemedicine to connect hospitals and CHCs*

Telemedicine is the use of electronic communications to provide clinical services remotely. Using the Internet, a patient can visit a clinic or hospital and get a diagnosis or treatment from a doctor in another facility. (For information about care in non-clinical settings, see the section on remote monitoring, below.) Examples include remote consultations with experts, remote diagnoses using images and pathology reports, remote intensive care,[156] and even remote surgery demonstrations.

Telemedicine brings precious health-care resources to patients in underserved areas, reducing the duration of hospital stays and saving travel costs for patients. Xinjiang Renmin Hospital reduced its upward transfer rate (relocation of patients to higher-tier hospitals) to less than 7 percent through its telemedicine system, which connects the hospital with Qilu Hospital of Shandong University.[157] Zhejiang Province implemented a telemedicine system that connects ten provincial hospitals, 150 city hospitals, and more than 500 CHCs. Between 2007 and 2012, Zhejiang had more than 16,000 remote expert meetings and 3,500 remote intensive care cases. The new system reduced the average in-patient cost by 12.5 percent, the upward transfer rate by 38.3 percent, and the number of disputes by 28.6 percent.[158] Beyond the monetary incentives, doctors from higher-tier hospitals may welcome telemedicine as a way to gain exposure to challenging and unique cases and research opportunities.

Telemedicine has advanced very quickly in China, and the government strongly supports its development. Practitioners at the 301 Military Hospital (People's Liberation Army General Hospital) in Beijing conducted 5,000 remote expert

156 Remote intensive care uses telecommunications technology—two-way cameras, video monitors, microphones, and alarms—to diagnose patients and provide round-the-clock care.

157 Ying Pan, "Xinjiang three-tier remote consultancy platform helps to relieve difficulties of patient visits," Xinhua news agency, June 2011.

158 Lanjuan Li, "Digital health: Boost medical reform and healthcare service—China Digital health overview," *Chinese Journal of Practical Internal Medicine*, 2012.

meetings in 2013.[159] In 2010, the Ministry of Health required all midwest provinces to select one Class 3 hospital to form a telemedicine network with five remote county-level hospitals within the province; it also designated 12 leading general hospitals in various provinces to establish one-on-one telemedicine systems with 12 midwest provinces.[160]

The future of telemedicine seems bright, but some complexities may slow its penetration. The system needs an incentive scheme to ensure that large higher-tier hospitals make their resources available; profit-sharing arrangements will need to satisfy both health-care institutions and physicians. Because telemedicine patients are usually in lower-income regions, insurance coverage could help with affordability. As telemedicine expands, integrating it into the standard quality supervision system will be necessary to protect consumer rights. At this stage, many physicians still have reservations: they believe that seeing the patient in person is necessary to make reliable judgments. Selecting a few diseases that are more suitable for remote diagnosis and showing early success could help break through this resistance.

### *Online consultancy platforms*

These platforms connect patients and physicians online (see Box 7, "Haodaifu finds its niche in scheduling and consultancy"). Chunyuyisheng, for example, has more than 15 million Chinese users and 10,000 registered physicians. It generates 250,000 questions every day.[161] These platforms usually provide free consultations, but some have started charging membership fees. An estimated 5 to 7 percent of Chunyuyisheng users have become members, paying RMB 8 for monthly membership or RMB 80 for annual membership, which entitles them to ask unlimited questions and receive an answer within 20 minutes. Non-members are limited to one answer every ten days.[162]

The indirect cost related to obtaining a consultation is RMB 209 per outpatient, according to the Ministry of Health.[163] Online consultancy can help save on travel costs and enable patients to contact experts whom they could not engage otherwise. Fewer unnecessary visits could save patients billions.

In the United States, around 35 percent of the population has used the Internet for self-diagnosis, and 53 percent of those people followed up with a medical professional. Twelve percent of younger consumers in China use social media to get information about treatments and medications, according to a McKinsey survey. The Internet has already replaced more traditional sources of information such as print media, which are used by less than 10 percent of patients considering a particular decision.

Although online consultancy has attracted many loyal users, there is not widespread trust in this approach. The quality of physicians' answers is not ensured, and opting for the wrong treatment could have serious consequences. Some experts estimate that more than 100,000 counterfeit websites (including

159 Xiaoming Han and Xuejun Feng, "Telemedicine: Solving healthcare resource shortages remotely," *People's Daily*, April 21, 2014.

160 *2010 management plan for remote consultation system design project*, Chinese Ministry of Health, March 2011.

161 Chunyuyisheng website.

162 Xiaobo Gu, "Chunyuyisheng's pain: Why it is hard to start charging," eNet, January 2014.

163 Ministry of Health, Statistical Yearbook, 2012.

fraudulent hospital websites) are engaging in online fraud.[164] In addition, most online consultations happen outside of hospitals and are provided by physicians during their leisure hours. Legal responsibility for incorrect advice is unclear. Patient privacy is another concern, though some online platforms are trying to protect patient information by scrutinizing physicians' backgrounds and requiring authorization for the release of personal information. Regulatory gaps must be closed to protect the rights of both patients and physicians.

### Box 7. Haodaifu finds its niche in scheduling and consultancy

Founded in 2006, Haodaifu originally offered real-time updates of hospital outpatient schedule information systems. Currently, it manages schedules for more than 3,200 Chinese hospitals in 31 provinces and regions, more than 80,000 hospital departments, and more than 300,000 physicians. For key hospitals, Haodaifu updates schedule information daily.

In addition, Haodaifu is China's leading physician-patient consultation platform, with more than 57,000 doctors from across the country answering patients' questions at no charge. Haodaifu also set up the first online referral system allowing patients with severe diseases to make appointments with physicians who specialize in their conditions. This system helps to reduce inefficiency by directing patients to the most appropriate physicians rather than the most famous ones.

#### *Remote monitoring of patients with chronic diseases*

Remote monitoring refers to technology that collects clinical data from patients in remote areas (usually at their homes), then transmits the information to health-care providers for clinical review and patient education. Remote monitoring can cover a wide range of diseases, such as asthma, chronic heart failure, chronic obtrusive pulmonary disease, diabetes, depression, anxiety, and so forth (see Box 8, "New models for remote monitoring").

Remote monitoring could improve treatment results, reduce health-care costs, and increase access to care. Many studies have tried to quantify its benefits. In the United States, 18 percent of hospital patients are readmitted within 30 days, but three-quarters of those admissions could be prevented with proper follow-up care. One study estimated that $12 billion a year could be saved if remote monitoring were widely adopted in the United States.[165] Some 250,000 US patients are currently under remote monitoring, and that number is predicted to rise to three million by 2018.[166] A US Department of Veterans Affairs pilot program testing remote monitoring for more than 17,000 veterans achieved a 63 percent reduction in hospital admissions and an 88 percent reduction in nursing home bed days of care.[167]

164 *Annual report of the Anti-Phishing Alliance of China*, China Internet Network Information Center, December 2012.

165 Jane Sarasohn-Kahn, *The connected patient: Charting the vital signs of remote health monitoring*, California HealthCare Foundation, February 2011.

166 Bruce Japsen, "Obamacare, doctor shortage to spur $2 billion telehealth market," *Forbes*, December 12, 2013.

167 *Home telehealth: Enhancing care, saving costs*, Home Care Association of New York, September 2012.

Chinese researchers have studied the effects of remote monitoring, and among 19 recent publications, all suggested that remote monitoring produced better results than traditional medical care.[168] More than 2.3 million wireless wearable sensors were used worldwide in 2012.[169] But only 24 percent of Chinese patients who responded to a survey said they understand remote monitoring.[170]

Remote monitoring faces multiple challenges, starting with the availability of practitioners to review patient data promptly. The high cost also limits adoption. Under the fee-for-office-visit model, physicians lack an economic incentive to engage in remote monitoring, and patients hesitate because there is little insurance coverage for this approach. In the United States, the Affordable Care Act attempts to address these types of incentive issues by using a "pay for value" model that is meant to encourage physicians to help patients lower treatment expenditures by creating ways for them to share part of the savings. This aspect of US health-care reform could be relevant to China as well; the current system, which is highly subsidized by drug sales and relies on artificially low compensation for services, may keep remote health monitoring from realizing its full potential. Successful cases show that this model works only in a collaborative ecosystem uniting multiple parties, including device designers and makers, data storage providers and processors, and health providers. As with other information-intensive services, data sharing and privacy protection issues should be formally addressed by a regulatory framework.

### Box 8. New models for remote monitoring

Life Care Networks provides 3G-enabled cardiovascular screening and monitoring systems to CHCs in Shandong, Anhui, and Chongqing. The system has three parts: smartphones with built-in electrocardiogram sensors; Web-based electronic medical record software; and workstations located within the clinics, each with a computer terminal providing health-care workers with instant access to electronic patient records, including electrocardiogram data. The system sends data to cardiac specialists in the Beijing Life Care Networks call center, where more than 60 physicians are on duty to analyze the data to provide rapid feedback to smartphone users.

Since the program was implemented in July 2011, some 100 community doctors have used the system and more than 11,000 patients in four CHCs have tried it. The system flagged 1,171 patient participants, who were screened for serious cardiovascular conditions and referred to higher-level health-care institutions for further treatment.

New Element has launched the "one-hospital online center" and the "N health clinics" models, and so far, more than 300 hospitals have enrolled. The one-hospital online center is a separate facility within a hospital that provides remote monitoring services. The clinics are terminals equipped with health monitoring tools that provide care for senior citizens and patients with chronic diseases. Physicians are notified when abnormal risk factors appear, and patients can log in to a portal to generate health assessment reports suggesting personalized workout plans, dining plans, lifestyle plans, and more.

New Element receives revenue from three sources: member hospitals' fees for patient registration at the hospital online center, individual patients' membership fees (RMB 200 per year), and sales of monitoring equipment.

168 Xuefei Li et al., "China remote monitoring, research landscape analysis," *Journal of Evidence-Based Medicine*, 2013.

169 *China mobile health market research annual report (2012–2013)*, iiMedia Research Group, April 2013.

170 Ibid.

### Treatment quality and consistency

The Internet can play a role not only in expanding access to care but also in elevating the quality of care and reducing errors.

*Clinical decision support systems*

A clinical decision support system (CDSS) assists health-care practitioners with diagnosis and decision making. One of its basic functions is screening prescriptions and providing detailed usage instructions; a CDSS provides alerts regarding drug interactions, overdoses, allergies, repetitive prescriptions, side effects, and improper medication of pregnant women. Reducing medication errors could help avoid complications for patients and lower health-care expenditures.

More than half of respondents in a survey of 870 physicians at Harvard-affiliated hospitals in the United States said they believe that CDSS could help them to avoid at least one medical error per week. In the United States, medication errors lead to an estimated 44,000 to 98,000 deaths each year.[171] Studies have shown that CDSS could prevent a significant share of medical errors.[172] In China, a similar situation exists. Overdoses of antibiotics are an alarming example. China's per capita annual consumption of antibiotics is around 138 grams, compared with only 13 grams in the United States. More than 80 percent of the use of antibiotics in China is attributable to overuse, resulting in 80,000 deaths every year.[173] One study found that 39 percent of medication errors in China are avoidable.[174]

China's use of CDSS started in the 1990s, and so far 5 to 10 percent of public hospitals use them for prescription screening. But only around 100 hospitals have a CDSS with a complete drug knowledge base.[175] A CDSS is most powerful and helpful if the databases are updated, accurate, and complete, which requires continuous collaboration by the government, academia, and IT companies. Multiple software systems and embedded databases are available, but regulations need to be in in place to ensure quality and standards. Meanwhile, IT companies can continue to drive the user experience for physicians; experts have found, for example, that repetitive reminders could fatigue and distract them. Appropriate training should be provided to ensure that physicians are comfortable with the technology. Further adoption also relies strongly on basic infrastructure, including the use of electronic medical records and hospital information systems.

171 Lin Xu, "Clinical insecure medication analysis," *China Pharmaceutical News*, March 2009.

172 "Reducing and preventing adverse drug events to decrease hospital costs," *Research in Action*, Issue 1, Publication 01-0020, US Department of Health and Human Services, March 2001; Zhiang Wu, "CDSS system progress overseas and in China," China Information System conference, 2012.

173 Beibei Zhao, "Overtreatment shows the pain point of China healthcare: Physicians write 'big prescription,'" *People's Daily*, November 2010.

174 Fang Liu and Xiaole Zhang, "Root and categorization of medication errors," *China Medical Tribune*, November 2011.

175 Zhiang Wu, "CDSS system progress overseas and in China," China Information System conference, 2012.

### *Physician learning portals*

Science and health-care technology are constantly evolving; studying new research results, techniques, and medicines is a lifelong job for health-care professionals. Doctors are beginning to turn to online platforms and apps that disseminate cutting-edge knowledge.

Before online learning became available, physicians usually participated in summits and conferences to hear about new trends, but now they can go online to stay up to date with the latest breakthroughs. In a 2012 survey, 62 percent of the 522 Asian physicians queried said that they had changed a diagnosis because of new knowledge acquired from online sources.[176]

Ding Xiang Yuan was started in 2000 as a platform to share research papers from around the world. Today roughly three million professionals use it, including approximately 880,000 licensed physicians, and it has accumulated 300,000 case studies. The service has expanded to include information on drugs, conferences, and policies; blogging services; career services; and an online store for laboratory reagents and equipment. In the near future, the company will generate business insights for companies from its large physician user base. Pharmaceutical companies, for example, could develop more precise manufacturing and marketing plans if they have a better estimate of the number of operations done in a certain hospital or region.

These learning platforms do not find it hard to acquire users, especially in large cities and high-grade hospitals, where physicians are more tech-savvy and face peer pressure to stay at the top of their profession. The platforms are expected to be even more valuable to physicians in remote areas, where information on the latest developments in medical research is less accessible. Penetration of smartphone and mobile networks is expected to have a significant impact on the further adoption of learning portals in rural areas. Today, these portals rely on physicians' self-motivation to take advantage of their offerings. A more effective incentive system for physicians—for example, allowing them to practice at multiple sites and build their practices—will greatly enhance motivation, because they can monetize their enhanced skills.

### *Clinical pathways*

"Clinical pathways" are standardized methods for treating certain diseases, which could help to ensure a consistent quality of care, lower health-care costs, and improve outcomes. In 2009, the Chinese Ministry of Health piloted this approach in 110 hospitals in 23 provinces.[177] By the end of 2012, the ministry had established clinical pathways for more than 430 diseases. By July 2013, it had rolled out the pilot to more than 5,900 hospitals, including 78 percent of public Class 2 and 3 hospitals. The ministry aims to cover all Class 3 hospitals and 80 percent of Class 2 hospitals by the end of 2015.[178]

176 "Physicians and consumers online behavior survey," Ipsos Healthcare and Ruder Finn Asia Health and Wellness, January 2013.

177 *National clinical pathway management pilot assessment summary*, Ministry of Health, April 2012.

178 Meng Sun, "Clinical pathway's three-year plan," *Health Journal*, September 2013.

A 2012 government assessment showed that clinical pathways reduced death rates by 0.12 to 1.34 percent and that expenditures on medicine decreased 4.5 to 65 percent per visit for 60 percent of diseases.[179] Although clinical pathways can be implemented without using the Internet, electronic health records and Web-enabled tracking systems could help with supervision and facilitate rollout.[180] Previously, the government had to take samples—paper-based prescriptions—from a few hospitals to ensure that clinical pathways were being followed. Now officials can use Web-based systems to review prescriptions and medical practices for every physician, automatically detecting deviations. The Bureau of Health in Shanghai's Minhang district, for example, used its electronic medical record system to track and analyze all prescriptions and identify cases with abnormalities such as the overuse of antibiotics. Connecting electronic health records through the Internet can enable providers to make use of comparative effectiveness studies, identifying the clinical pathway that is most effective and efficient for a particular patient profile.

## Innovation, productivity, and transparency in the pharmaceutical and medical device segments

The Internet has a number of applications that can transform the way drugs and devices are developed, monitored, and sold.

### *Big data in research and development*

Big data can transform R&D, allowing wider-scale collaboration among pharmaceutical companies, clinical-research organizations, academics, and patients. Large quantities of real-world data, which were not previously available to scientists, could be used to create a more effective and targeted development model, helping to control costs. In addition, tools such as dynamic sample size estimation and patient recruitment management could make clinical trials more efficient. Big data has the potential to expedite the R&D phases and bring new products to market earlier than traditional R&D processes.

The Chinese government has stressed enhanced pharmaceutical R&D as an important goal. The 12th Five Year Plan allocates more than RMB 35 billion to fund biomedical R&D. However, the adoption of big data in R&D is still quite limited in China and elsewhere. Two examples are Merck—which partnered with the China Cardiovascular and Metabolic Diseases Research project to set up patient registries and collect 25,000 Type 2 diabetes records to guide R&D—and the announcement of a leading Beijing cancer hospital that it was partnering with Roche on a similar effort in research on gastrointestinal tumors.

Expanding the use of big data in R&D will require overcoming a number of hurdles, most notably that organizations tend to collect data in silos, which are not easily broken down. Many pharmaceutical companies also believe that there is not enough certainty of better outcomes to justify the investment in improving big-data analytical capabilities. There is also a shortage of highly specialized analytical talent. In addition, China's health record and information availability make using big data even more difficult.

179 *National clinical pathway management pilot assessment summary*, Ministry of Health, April 2012.

180 We did not quantify the impact because it is indirect.

### *Drug electronic supervision codes*

A drug electronic supervision code is a barcode that enables full supply chain supervision of pharmaceuticals. The system helps to expedite the recall of drugs in an emergency and provides alerts about drugs produced without the permission of China's Food and Drug Administration. Tracking allows inspectors and regulators to go online to identify drug abuse and predict the prevalence of certain diseases.

In 2012, 14,000 cases of counterfeit drugs were detected in China, with a value of RMB 16 billion. The government aims to ensure that 100 percent of illegal drugs are kept out of the legitimate circulation market and to reduce counterfeits to less than 3 percent of all drug safety incidents.[181]

Since 2006, when China started to roll out electronic supervision codes for drugs, the codes have covered 32 percent of all drugs and 63 percent of drug manufacturers. In the 12th Five Year Plan (2011), codes got another push; the government aims to institute electronic monitoring of all kinds of drugs. However, drug manufacturers argue that the codes substantially increase their costs, as they are required to invest in barcode printers and readers and to reform production lines to adapt to new procedures. Some manufacturers have reported lowered productivity and increased rework rate as a result.[182]

### *E-marketing to physicians*

Pharmaceutical and medical device companies can market to physicians through online ads, targeted marketing, and "e-detailing" (in which sales representatives use electronic tools such as iPads to explain product details). E-marketing could help the industry reach the right audience at a lower cost, thus improving marketing and sales efficiency. Online advertising for hospitals could have a return on investment as high as 54 percent, according to research conducted in 2013.[183]

E-marketing players such as eDoctor have provided online channels for pharmaceutical companies to create professional videos that introduce their products to a large physician member base. Currently, online marketing counts for less than 10 percent of total marketing budgets.[184] But several forces are accelerating adoption, including the government's efforts to combat physician bribery and wider acceptance of online media among physicians.

### *Online patient education and service*

Pharmaceutical companies are trying to build patient loyalty through third-party platforms and self-built apps and websites that can educate users about particular diseases and conditions as well as the treatments that are available. Online patient education and services provided by pharmaceutical and medical device companies are still at a nascent stage, but they could be a way for companies to build more direct relationships with consumers.

181 Jiandong Fu, "Pharmaceutical supply chain monitoring and tracking: Drug electronic supervision code," GICOM enterprises, November 2010.

182 Chao Wang, "Drug electronic supervision code in dispute," *China Youth Daily*, April 2012.

183 *China hospital advertiser online marketing report*, iResearch, 2013.

184 Expert interview.

### *E-commerce for OTC treatments*

E-commerce for over-the-counter treatments, similar to other categories that are expanding their online presence, could help to decrease the cost of drug sales, add sales channels for drug manufacturers, and make drug flow supervision more convenient. OTC e-commerce players such as Jiuzhoutong are reporting higher margins because of efficient logistics. Jiuzhoutong's online drug sales gross margin could reach 20 percent, compared with offline margins that usually hover around 3 to 5 percent.[185]

Purchasing drugs and medical devices online is widely accepted in the United States, where OTC and non-OTC sales from various online e-commerce platforms accounted for 30 percent of the total drug retail market by 2010.[186] Chinese citizens are just beginning to shift to buying medications online. OTC e-commerce accounts for less than 1 percent of the total drug retail market, but its growth rate has been 200 percent annually over the past three years.[187]

The further penetration of OTC e-commerce depends largely on delivery logistics. Unlike other products, medications must be delivered in a timely fashion, and faster and more reliable logistics management is still a challenge for many new e-commerce players. Non-OTC drugs, a larger share of the pie, are still outside the realm of e-commerce. Large pharmaceutical companies are willing to expand online; however, they are still waiting for OTC e-commerce to scale up before they move forward. Policies and procedures to prevent the sale of fraudulent pharmaceuticals will also be needed.

## POTENTIAL IMPACT ON GDP AND EMPLOYMENT

The Internet could save RMB 110 billion to 610 billion in annual health-care expenditures, which is 2 to 13 percent of the incremental growth in health-care expenditures projected from 2013 to 2025 (Exhibit 18).[188] This lower spending and improved efficiency could also lead to a reduction of 70,000 to 300,000 jobs (equivalent to up to 2 percent of sector employment) within pharmaceutical companies, medical device companies, and hospitals.[189]

Patients, however, are likely to see clear benefits in the form of cost savings. But as care becomes more accessible and affordable, more patients will seek out services and increase spending on online apps and wearable devices. In the end, the changes will still drive an overall reduction in spending because these innovations will make the system more productive.

185 Xuefeng Li, "Internet giant taking stake in the meat and potatoes of online pharmacies," *Securities Times*, February 2014.

186 Jianrong Lin, "Online pharmacy in dilemma," *China Business News*, October 2012.

187 *China pharmaceutical B2C market analysis*, Sootoo research, 2013.

188 Baseline projections are from Business Monitor International, while the Internet-enabled growth is estimated based on our research through extensive expert interviews. Productivity gains are estimated by assessing the cost base affected, adoption rate, and potential cost savings percentage. New market creation is estimated by assessing the penetration of new offerings, the ratio of incremental market growth vs. the existing market, and the value add of the new market.

189 This employment estimate considers only the impact of the Internet applications described above on the health-care sector and associated value chains. It excludes cross-sector impacts from capital reallocation and incremental demand.

Pharmaceutical and medical device companies could use the Internet in targeted marketing, R&D, and other areas to generate incremental GDP. The Internet will help reduce costs to patients and will increase demand. With more advanced R&D and marketing tools, companies could also generate additional revenue by developing more effective and more personalized drugs.

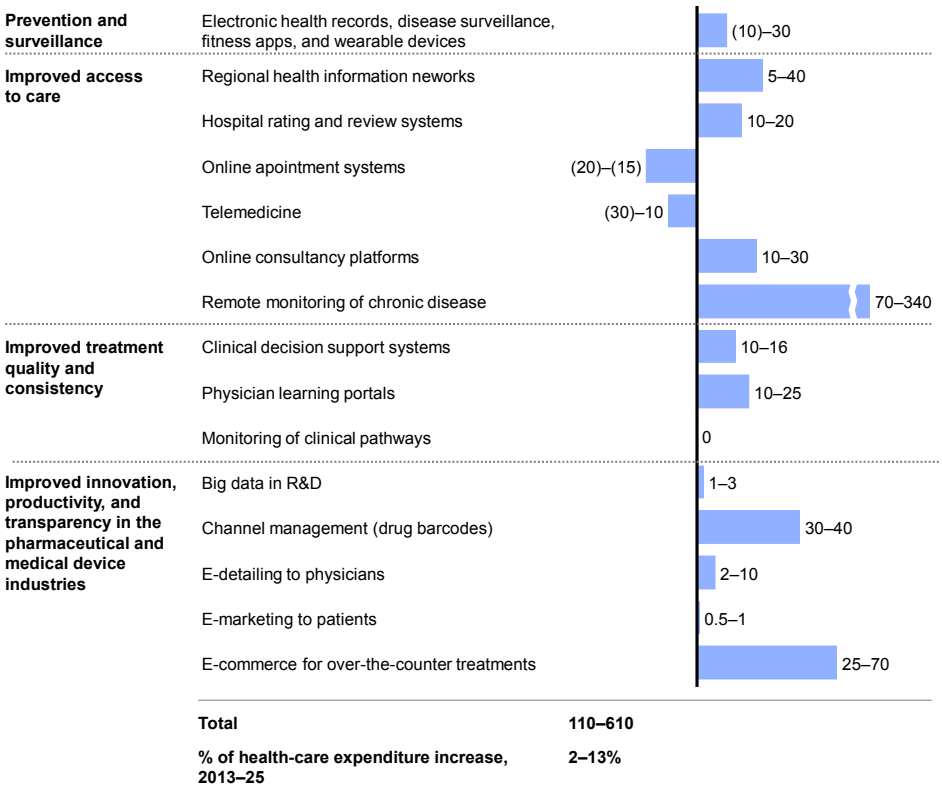
As they integrate Internet-based technologies, hospitals could shed their patient-care staffs while holding physician productivity constant. Physicians should also start to move from crowded Class 3 hospitals to lower-tier hospitals as the patient load is reallocated. As primary care becomes increasingly important, general practitioners will be in great demand and the mobility of physicians will be increasingly important. Pharmaceutical and medical device companies will need smaller labor forces because of increased efficiency.

**Exhibit 18**

**Internet technologies could save up to RMB 610 billion in annual health-care expenditures by 2025**

**Potential savings in 2025**

RMB billion




NOTE: These savings cannot be translated directly into GDP gains, as GDP is measured differently for public and quasi-public sectors in national accounts. GDP in the government and health-care sectors is based on spending, not the value of output.

SOURCE: McKinsey Global Institute analysis

On top of the direct savings mentioned above, a more efficient health-care system will bring enormous indirect economic benefit. Fewer working-age people taking sick leave or caring for sick relatives will help to increase overall labor productivity. Better treatment results and more convenient access to health-care information and resources will save patients huge amounts of time and money that can otherwise be invested in productive activities. Not only will wait times be reduced in major cities, but rural patients will be able to take advantage of telemedicine rather than traveling long distances for face-to-face consultations.

Improved health will result in a more productive workforce for the nation as a whole, and research shows that the impact of health on GDP could be substantial. An extra year of life expectancy could raise a country's per capita GDP by about 4 percent.[190] As East Asia's life expectancy rose from 39 years in 1960 to 67 years in 1990, the region experienced a sharp rise in GDP. Using the disability-adjusted life year as a measurement, the Internet could help to save RMB 40 billion to 80 billion of productivity losses annually. The Internet, with its power to elevate public health, improve treatment quality, and increase health-care efficiency, will contribute to this trend, thus adding substantially to China's human capital and overall GDP.

## AGENDA FOR MAJOR STAKEHOLDERS

Hospitals and CHCs are struggling to develop sustainable business models in the face of increasing patient loads, funding difficulties, and talent shortages. Accelerating adoption of the Internet-based tools described above can provide at least part of the solution to these challenges, although providers will have to train their personnel to make the transition.

Pharmaceutical and medical device companies could use the Internet to increase R&D and marketing productivity, and they could also find opportunities in e-commerce channels. The Internet is accelerating the pace of innovation in health care, so established health-care companies will have to stay up to date with developments at the cutting edge and be open to learning and adapting.

For third-party players such as app developers, wearable device companies, and online platforms, it is clear that the future is bright—but serious attention must be paid to managing the quality of content and the user experience. Valuable content is the key to customer loyalty. Self-regulation mechanisms such as content screening and physician scrutiny will need to be implemented.

Government intervention will be needed to facilitate a real technology revolution in health care. The right policies can encourage hospitals to adopt electronic health records, Web-based RHIN management systems, online appointment systems, and CDSS. With government support for collaboration and standard-setting within the industry, open data can provide patients with better hospital performance reviews, health record sharing, and other benefits. At the same time, privacy is paramount when it comes to personal medical information. New regulations will be needed to control risks, monitor the quality of emerging health-care services and products, and guard against fraud and misleading information originating online. Initiatives such as electronic health records and RHINs are

190 David E. Bloom, David Canning, and Jaypee Sevilla, "The effect of health on economic growth: A production function approach," *World Development*, volume 32, issue 1, January 2004.

moving in positive directions, but incentive systems within hospital business models and parameters for insurance coverage may need to be updated.

Allowing physicians to move up to higher-tier hospitals could also be helpful, as it would ensure that young practitioners would be willing to serve at CHCs and would give CHC personnel greater incentive to master new technologies. The government may also have to play a role in cultivating sufficient technical and analytical talent to ensure that the health-care industry is prepared to fully embrace the Internet's potential.

In the end, patients themselves will have to carefully guard their privacy and learn to maximize the new resources available to them online while keeping an appropriately skeptical eye on the quality of the sources. Physicians, too, may need to break out of long-held professional habits to take advantage of the new tools and communication channels that are made possible by the Internet.

□ □ □

The finance, real estate, and health-care sectors underpin some of the most critical services in any economy—and the Internet is a powerful tool for making them more innovative, efficient, and transparent. Unleashing the Internet's full potential in these areas could have far-ranging economic and societal benefits. While technology adoption poses unique implementation issues within each sector, it also raises a set of common challenges. The next chapter will explore some of the critical questions facing policy makers and business leaders as they navigate China's digital transformation.

# 4. China's digital agenda: Capturing the Internet's full potential

Capturing the full economic benefits associated with the Internet is not a foregone conclusion. We project that if adoption of the applications discussed in this report continues on its current trajectory, the Internet could enable 7 percent of total GDP growth between 2013 and 2025—but if China makes the digital transition more rapidly, the Internet could potentially enable up to 22 percent of total GDP growth through 2025.

In other words, about two-thirds of the potential economic growth associated with new Internet applications depends on both a supportive policy environment and individual companies' willingness to transform their traditional ways of doing business. Individual workers, too, will have to cultivate new skills and adjust to the demands of a more digital economy. The stakes—which add up to some RMB 10 trillion in annual GDP by 2025—are high.[191]

## China's government faces multiple policy challenges in harnessing the Internet for economic growth

Given the Internet's ability to accelerate growth in productivity and GDP, facilitating more widespread adoption is a policy priority for China. In fact, government entities themselves have an opportunity to streamline their own operations through the use of Web-based systems and tools (see Box 9, "E-government: Using the Internet to improve the delivery of public services").

But the Internet can also be a disruptive force, and the government will need to manage the risks associated with its growth. The section below highlights some of the major challenges facing China's government as it seeks to create a robust policy framework and address the economic and societal changes surrounding Internet adoption.

191 This figure refers to the difference in GDP impact between the low and high scenarios for Internet adoption, in 2013 terms. Overall GDP growth potential was estimated by applying the ratio in the sectors analyzed in this report to the size of private industrial and service sectors across the economy.

### Box 9. E-government: Using the Internet to improve the delivery of public services

The Internet can be a powerful tool for boosting the productivity and effectiveness of government agencies as well as connecting citizens with public health and safety information. Governments at all levels can use Web-based tools and systems to manage information, integrate workflows, and create new channels of communication with citizens. They can also produce substantial cost savings: A recent MGI study estimated that if the United States used big data analytics in government purchasing, the federal government could lower its procurement costs by up to $140 billion annually by 2020.[1]

From tax collection to the issuance of visas and the renewal of driver's licenses, a variety of citizen-facing services and back-end processes can move online, as international case studies show. An "e-filing service" introduced by the South African Revenue Service, for example, creates a simplified process for filing tax returns online and gives taxpayers quick access to their tax history. This effort has greatly reduced the administrative burden on both the revenue service and the taxpayer, streamlined turnaround times for refunds and penalties, and improved accuracy. Since its introduction in 2003, e-filing has become the preferred mode of tax submission for 5.5 million South African taxpayers and has contributed to significant improvements in revenue collection.[2]

Governments are also beginning to use geospatial information systems (GIS) to deliver services. The United Kingdom's National Health Service uses GIS data to identify areas with a large proportion of smokers and patients with chronic lung diseases; it assesses this information to decide where to locate its smoking-cessation programs. GIS data can be particularly useful for delivering local services. In the United States, Boston has created the "Citizens Connect" app for residents to report quality-of-life issues such as graffiti and the "Street Bump" app to record the location of potholes; the city also uses GIS data to deploy its snowplows to clear streets after winter storms.[3]

China's central government departments, provincial-level governments, and municipal governments are making steady progress in rolling out websites and e-government services. However, China ranked 70th in the latest UN e-government survey, indicating that there are many efficiency gains still to be captured from continuing to build out these services.[4]

1 *Game changers: Five opportunities for US growth and renewal*, McKinsey Global Institute, July 2013.

2 *Lions go digital: The Internet's transformative potential in Africa*, McKinsey Global Institute, November 2013.

3 Andrew Grant, Rohit Razdan, and Thongchie Shang, "Coordinates for change: How GIS technology and geospatial analytics can improve city services," *Innovation in local government: Open data and information technology, Government designed for new times*, McKinsey & Company, March 2014.

4 *United Nations e-government survey 2014: E-government for the future we want*, UN Department of Economic and Social Affairs, June 2014.

## ENHANCING THE POLICY FRAMEWORK FOR PRIVACY PROTECTION AND DATA SHARING

A great deal of the Internet's potential for value creation across all sectors stems from data sharing and use. In health care, for example, combining hospital reviews and ratings from multiple users can make outcomes and patient satisfaction more transparent, leading to improved performance, while the sharing of electronic medical records across multiple hospitals can lead to better continuity of care for individuals and more effective public health management. In financial services, big data analysis of the credit histories of small businesses and their owners could reduce the risk of default, encouraging banks to increase their lending to SMEs. Recent MGI research found that open data could unlock some $3 trillion in annual value by giving rise to new entrepreneurial businesses and helping established companies segment markets, define new products and services, and make their operations more efficient.[192]

192 *Open data: Unlocking innovation and performance with liquid information*, McKinsey Global Institute, October 2013.

A recent survey showed that Chinese consumers are more willing than consumers in many other countries to trade online privacy for convenience.[193] But this does not mean China's Internet users are unconcerned about the possibility of fraud or data breaches. Many individuals are justifiably worried about the possibility that their personal information will be used or even leaked without their consent, especially if it relates to their health or wealth. These concerns are heightened when online information can be linked to a consumer's physical location, as in the case of Internet-based community services being offered by real estate developers. Without a comprehensive regulatory framework in place to reassure consumers and create certainty for the private sector, this lack of trust could constrain China's ability to maximize the uses of big data and open data.

Recognizing these concerns, the government announced a preliminary set of rules regarding online privacy in late 2012.[194] However, additional measures may be needed to create clear penalties for violators and to put sufficient resources into enforcement. A public awareness campaign may also be needed to educate both consumers and Internet companies about the importance of safeguarding personal information and online privacy.

In addition to setting minimum standards for privacy protection, the government has a role to play in facilitating more widespread sharing of data. Big data is most powerful when it combines various types and sources of information, but even with consumers' consent, companies and organizations may be reluctant to share personal data with external parties because of concerns about legal and reputational risks. Sharing data with third parties, even legally, might be perceived as leaking customer information. A balanced set of regulations governing the kinds of data companies can share, the types of usage that are not allowed, and the type of consumer consent that is required could address these obstacles.

The government can create significant momentum by making its own data sets publicly available or by specifying data format standards for certain types of information. This can release the raw information necessary to allow new types of innovation to thrive: map providers can reduce costs by using traffic data the government has already gathered; e-commerce platforms can easily verify the identity of corporate customers with official government registrations; and a greater number of clinical results compiled from various hospitals can provide better guidance for administrators and policy makers in determining the best cost-benefit trade-offs in health care.

The US government is already engaged in an effort to provide more open data; its data.gov website provides easy access to a growing pool of public information in standardized format. The United Kingdom has created the Information Commissioner's Office, an independent authority whose mission is to balance the need for public-sector openness with data privacy for individuals. It recently issued a code of practice containing guidelines for compiling large data sets while "anonymizing" the contents (scrubbing the personal identifications attached to each piece of data).[195]

193 On the EMC Privacy Index, China ranked third out of 15 countries in terms of willingness to trade privacy for convenience, based on survey responses.

194 The Decision Regarding Enhancing Information Protection over Internet and the Provisions on the Personal Information Protection for Telecommunications and Internet Users.

195 *Anonymisation: Managing data protection risk*, UK Information Commissioner's Office, November 2012.

China will face additional challenges in moving toward open data, as some public information resides in outdated paper records. Even if data sets exist, they may not be of sufficient quality to be useful. Internet-based information services in the real estate sector are usually built from transaction data, which might not exist across China. The government could also potentially use the Internet to establish more complete data gathering and sharing processes for future transactions, enabling even more opportunities for digital innovation.

## LIBERALIZING MARKETS TO ENCOURAGE NEW INNOVATIONS

Regulations governing established industries will determine the degree to which companies are able to realize Internet-related productivity gains and create new markets for digital products and services. In sectors where there is already relatively open competition—such as consumer electronics, automotive, and chemicals—government regulation may not be a decisive factor. Companies themselves largely control how the adoption of the Internet affects productivity in R&D, supply chains, and sales and marketing. But in other sectors such as financial services, government policy sets ground rules that can constrain online innovation or allow it to thrive. For instance, the number of business lines that banks can move online will depend on regulations governing whether a particular transaction has to be completed in person.

Regulation is especially critical in the development of entirely new Internet-fueled markets. The likelihood that an online market for insurance products will scale up, for example, depends on how policy pricing is regulated. Online marketplaces can fuel sales of used cars, but regulations on cross-provincial transactions may need to be adjusted to unleash this fledgling market's full potential. Sometimes new regulations—or at least new interpretations of existing laws—are required to ease consumers' concern about participating in emerging business models. Entrepreneurs with great ideas could raise startup capital efficiently through crowdfunding, for example, but investors need the reassurance of knowing that crowdfunding is regarded as a legal investment channel that provides protection against fraud.

As regulations are updated, one central issue to consider is "letting the market mechanism function."[196] Competition and innovation go hand-in-hand. When companies face competitive pressures (both domestic and foreign), they are more likely to integrate Internet technologies more aggressively, which would speed the pace of adoption and allow China to capture the full economic benefits of productivity gains. Regulations that limit competition to a few incumbents could impede innovation and limit the potential value creation. In addition, the Internet can usher in heightened competitive intensity and creative destruction. Business failures and loan losses will occur, even for state-owned enterprises, and China will not be able to provide guarantees to every entity that is at risk. A clear, transparent market mechanism that allows for failures and resolutions will reinforce risk management and provide incentives for business owners to meet the challenges of this new environment.

196 *The decision on major issues concerning comprehensively deepening reform*, Third Plenum of 18th Central Committee of the Communist Party of China, November 2013.

While the Internet lowers entry barriers for small enterprises, it can also create large network effects and a "winner takes all" dynamic. The government may have to monitor how competition evolves to ensure that the broader economy benefits from maximum productivity gains.

Many breakthrough ideas will likely come from startups; in fact, many of China's Internet giants are relatively young companies themselves. Alibaba's C2C platform, Taobao, quickly grabbed market share from EachNet (which eBay acquired in 2003) to grow by a factor of about 90 between 2003 and 2005.[197] Since its founding in 1998, Tencent has grown to encompass 800 million active QQ users and expanded into a variety of Internet services, including WeChat.[198]

Aside from its role in pushing the boundaries of innovation, the SME sector is critical for another reason: its ability to generate jobs. This will take on added importance as established companies digitize their operations, potentially reducing their need for labor in existing activities. With increased government efforts to support entrepreneurs, SMEs will have a better chance to compete and drive economy-wide productivity gains. Creating a business in China requires 13 procedures, compared with six in the United States and five in South Korea.[199] But since 2012, the Chinese government has exempted SMEs from paying certain administrative fees; additional measures along these lines could help to support the sector's development. Creating a solid and predictable regulatory framework for Internet finance and digitization of banking processes can also improve SMEs' limited access to capital.

For innovation to thrive, established companies and startups must feel secure in their ability to benefit from what they create. Intellectual property (IP) protections are central to this, especially if they can allow innovators to realize positive spillover benefits that accrue to external parties. For instance, ARM licenses its IP to whoever wants to use it in the chips for various mobile devices. Its innovations provide a critical underpinning for the broader mobile device network and associated Internet applications, and the company's survival rests on proper IP protection. China's State Intellectual Property Office has made annual announcements over the past six years indicating that the government recognizes this issue, which is growing in importance as China produces more inventions (its number of patent applications has grown by double-digit rates in each of the past few years).[200] However, enforcement efforts could be stepped up given that huge amounts of digital content are still consumed without proper payment to copyright holders.[201] And while effective IP policies and enforcement are essential, they must be balanced by the need to allow new ideas to be disseminated and combined for innovation to accelerate.

Wider adoption of Internet technologies usually requires the support of multiple market participants, and the government can facilitate this by aligning incentives—especially in the "infrastructure" industries including health care and real estate. Electronic medical records, for instance, can reduce redundant

197 *China's e-tail revolution: Online shopping as a catalyst for growth*, McKinsey Global Institute, March 2013.

198 In Q4 2013; Tencent press release, April 2014.

199 *Doing business 2013*, World Bank, October 2012.

200 *White paper on the intellectual property protection in China, 2013*, State Intellectual Property Office of the PRC, April 2013.

201 Michael Kan, "China tightens online pirated content laws," *Computerworld*, April 23, 2012.

testing and treatment, thus lowering overall health-care expenditures—but they could also lead to lower profits for hospitals and other health-care companies. As long as the health-care payment system continues to encourage excessive use of medical resources by paying for the number of services rendered, providers will lack incentives to adopt new innovation, despite its huge benefits to patients and society. The government can encourage a shift to a more outcome-based compensation structure.

In most circumstances, existing regulatory frameworks can simply be expanded to accommodate new Internet-enabled products, services, and markets. The used car market, for example, was regulated long before the rise of the Internet, and regulations governing crowdfunding relate closely to bank regulations. Meanwhile, mobile medical devices may need approval from the Food and Drug Administration. Regulations governing Web-based innovations likely do not need to be created in a vacuum but can fit within existing regulatory frameworks for a given industry.

The Internet has dramatically accelerated the pace of change, and one of the government's main challenges will be keeping regulations current as the landscape continually evolves. Policy makers and regulators need to be fluent in the language of technology so they can participate in the flow of discussion with industry players, staying up to date with the latest innovations and thinking through their implications in a timely manner. Regulatory frameworks may need to be adjusted more frequently than in the past, as leaving new markets unaddressed can generate perceived risks and can discourage investment and consumers' willingness to adopt emerging ideas and products.

## DEVELOPING WORKFORCE SKILLS

As the Internet permeates the entire Chinese economy more deeply, it will create large ripple effects in the composition of the labor market, although it will likely have a neutral to slightly positive effect on the total number of jobs. Companies in established industries will find new ways to automate processes, and some assembly and service jobs will disappear. Additionally, some workers who are retained will find the nature of their work has changed. Bank tellers, for instance, may conduct fewer in-person transactions, but they may need to become proficient at helping customers set up Internet banking access and finding online resources. Some labor will likely be reallocated into Internet services or into new Internet-enabled markets, such as modern logistics, which supports e-tailing. At the same time, China's economy will have a greater need for knowledge workers, particularly those with specialized skills such as programming, big data analysis ("data science"), and user experience design who will find new roles within IT services.

Most individuals will probably have to change jobs more frequently than in the past. In the short term, this dislocation will be difficult for the affected workers, many of whom lack the skills that are in demand in a more digital economy. The government can ease this transition by collaborating with industry to ensure that training programs and other resources are available to help workers continually refresh their skills throughout their careers.

In addition, China can prepare for the future by adapting school curricula to cultivate greater digital literacy in the population at large, creating a true education-to-employment pipeline. In fact, the Internet holds great potential to improve the quality of education across all of China's regions at low cost—and this could be an important initiative to prevent inequality from deepening as non-public education costs rise faster than wages in sectors where most activities can be automated. The Internet can deliver high-quality educational content and learning aids via mobile phones, tablets, or e-books, and these new digital tools can produce rapid gains in access to education, teacher training, and learning outcomes. Another key opportunity lies in using big data to strengthen learning and teaching assessments.

## EXPANDING INTERNET INFRASTRUCTURE AND SETTING STANDARDS

Broadband and 3G networks are widespread across China's largest cities, but Internet access remains spotty in smaller cities and rural areas. Household broadband penetration in China stood at only 39 percent in 2013, lagging far behind developed economies such as the United States (70 percent) and Germany (61 percent).[202] The government's stated goal is to achieve 50 percent household broadband penetration and 32.5 percent 3G/LTE penetration by the end of 2015.[203] Building out networks is crucial to bringing more of the population online and facilitating greater Internet adoption by businesses; cloud computing and big data applications in particular require sufficient bandwidth.

The Internet requires foundations that extend beyond physical infrastructure, however, including the establishment of clear standards in areas where they are needed, such as the Internet of Things and the basic format of electronic health-care records. Adopting international technology standards instead of unique domestic standards can also improve the intensity of competition and thus potential productivity improvement, as well as China's ability to create products for export.

Even in areas where the government does not directly establish guidelines, it can accelerate the development of de facto industry standards by providing subsidies, directing public procurement in a particular direction, or launching projects specifically designed to drive innovation. In October 2013, the Ministry of Science and Technology named 20 cities, including Shenzhen and Nanjing, as pilot locations for "smart city" development (see Box 10, "Building 'smart cities' with Internet technologies"). The National Development and Reform Commission has provided RMB 1.5 billion to support the development of cloud computing.

Finally, the government can fund research into new technologies by academic institutions. Industry tends to invest only in technologies that are likely to be commercialized within three to five years, but supporting more basic research can feed the innovation pipeline in the longer term.

202 Household broadband penetration data, Pyramid Research, September 2013.

203 *Broadband China*, State Council of China, August 2013.

## Box 10. Building "smart cities" with Internet technologies

China is in the midst of a massive wave of urbanization, which goes hand in hand with economic growth. In fact, MGI research projects that some 440 emerging market cities will contribute almost half of global GDP growth through 2025—and more than 200 of them are in China.[1]

Yet large cities are complex to manage, and most big cities are unable to grow without creating strains on residents' quality of life, environmental sustainability, infrastructure, and social cohesion. The average Parisian, for example, spends four years of his life searching for parking spaces.[2] Beijing has rapidly developed a similar squeeze: in 2011, government data indicated that the city had only 2.5 million parking spaces for more than five million registered cars.[3] In fact, a recent ranking found that China's largest cities lag behind their international counterparts in a variety of social and economic measurements, with a notable gap in environmental benchmarks such as air quality.[4]

A new approach to urban planning will need to take a strategic and long-term view so cities and their surroundings can cope with the demands of growth—and begin to do more with less, spending resources wisely.[5] "Smart city" solutions are an attempt to address urban challenges holistically—and although their scope is broad, the Internet is a critical enabler for integrating and modernizing the way cities are managed and the way local governments engage with residents. As China's rapidly expanding cities continue to take shape, they have an opportunity to incorporate technologies and data-driven planning and management solutions into their city designs in a cost-effective manner. Installing broadband in new housing developments is much less costly than retrofitting existing neighborhoods, for instance.

The emerging trend of using sensors and digital devices in physical objects and machinery is enabling the birth of "smart" urban infrastructure. For example, smart grid technology and sensors in water and sewage systems can help avoid utility breakdowns, reduce leaks by up to 50 percent, and cut costs to businesses and consumers.

Likewise, smart transport systems that use sensors to monitor public transportation and highway traffic can change routes and provide updates in real time to reduce congestion and traffic delays. Optimizing traffic lights using real-time traffic monitoring reduces congestion by 15 percent on average. When London implemented a congestion pricing scheme—using electronic license plate readers to automatically check if cars have paid to enter the restricted zone—it reduced delays in the congestion-pricing areas by about 30 percent. Bus congestion delays fell 50 percent, and average traffic speed rose by 31 percent.

Amsterdam developed networked lighting that could be remotely monitored, allowing smart dimming during low traffic hours and accurate calculations of energy consumption. New York has launched an interactive platform that integrates information from open government programs, local businesses, and citizens to deliver information to residents through smart screens. Busan, South Korea, established a 10GB broadband information highway; this cloud platform provides developers with convenient access to municipal data from the city's information and transportation systems and delivers services to citizens through kiosks, citywide digital interactive displays, home access, and mobile access.[6]

In 2012, China's State Council emphasized the importance of smart cities, and in 2013 the Ministry of Housing and Urban-Rural Development announced a pool of pilot locations. This is creating a wave of investment and opportunities for technology firms and industrial companies to team up with local governments. Embracing the role of Internet technologies will be at the heart of getting "smarter."

1 *Urban world: Cities and the rise of consuming class*, McKinsey Global Institute, June 2012.

2 Wim Elfrink, "The smart-city solution," *McKinsey Quarterly*, October 2012.

3 Data from the Urban Construction and Environmental Protection Committee of Beijing Municipal People's Congress and from the Beijing Municipal Committee of Transportation; "Diagnosis on traffic congestion in Beijing," *People's Online Daily*, December 27, 2012.

4 *The China urban sustainability index 2013*, McKinsey Global Institute and the Urban China initiative, April 2014.

5 *How to make a city great*, McKinsey & Company, September 2013.

6 Shane Mitchell et al., *The Internet of Everything for cities*, Cisco, 2013.

## Companies should prepare for rapid change and intensifying competition

Transforming a traditional company into a digital business can be a disruptive process that involves rethinking everything from company culture to strategy, operations, organization, and outside partnerships. But the rewards can be enormous: one recent McKinsey study across ten industries found that a successful and comprehensive digital transformation can boost a company's bottom line by more than 50 percent over five years.[204] Below are some of the major considerations for business leaders.

### CULTIVATING A "CUSTOMER FIRST" MENTALITY

The Internet gives consumers new power to express their preferences and take their business elsewhere with the click of a mouse. In this environment, the customer's needs and desires have to guide every aspect of a company's operations. Given the size of the Chinese consumer market, companies have long been able to focus on large-scale production and mass market channels. But to respond to increasingly fragmented customer needs in a more digital marketplace, they can choose from a wider range of suppliers, glean more detailed customer insights, and produce a broader and more complicated portfolio of niche products that are better targeted to what consumers really want. Beyond product offerings, consumers expect companies to deliver a seamless, convenient, and personalized user experience across channels, including offline, online, and mobile. Both messages and offerings have to be carefully tailored to be compelling on online and mobile platforms. Chinese consumers are avid users of social networks, so adding social connectivity and building online communities can be powerful strategies for building word of mouth and brand loyalty.[205]

Perhaps the most crucial part of retaining digital customers is handling their personal data in a way that creates trust over the long term. The trade-off between maximizing the profit potential of data usage and protecting privacy is a delicate balance. Beyond minimum adherence to regulations, companies must actively engage customers to learn about their personal preferences and carefully integrate safeguards throughout their business processes. By soliciting their preferences and honoring boundaries, companies can gain their customers' trust in the long term. Business leaders will also have to be active partners in the regulatory process governing this issue, helping policy makers understand newly emerging Internet-related opportunities and risks in their industries. Both government and industry may still be figuring out the implications of new applications, and their complementary perspectives could form a complete picture.

204 Tunde Olanrewaju and Paul Willmott, "Finding your digital sweet spot," *McKinsey Quarterly*, November 2013.

205 Martin Hirt and Paul Willmott, "Strategic principles for competing in the digital age," *McKinsey Quarterly*, May 2014.

Competitors can join forces to build trust among the general public, as some Chinese Internet companies have done by signing onto industry self-regulation commitments. Companies can cooperate on educating consumers about the benefits of innovative new products or sharing personal data. Some benefits, such as the ability to obtain a subprime auto loan, are immediate, and customers will need less convincing. Other benefits might be more theoretical, as in the case of sharing medical records. Because current adoption is limited, companies may compile data at the industry level to make their case. They also need to be up-front about disclosure so that consumers do not sign up for risks that they do not understand or cannot bear. For instance, some new Internet finance products may not actually guarantee yield, although some investors might mistakenly assume that is the case.

## ADJUSTING STRATEGY TO PREPARE FOR A NEW WAVE OF COMPETITION

The Internet has unleashed a new era of intense competition, and companies have to be nimble and flexible to survive. It has, for instance, facilitated the growth of a new "sharing economy" in which consumers may shift from car ownership to car sharing, or from checking into a hotel to staying in a host's extra bedroom. These types of developments have the potential to disrupt entire industries.

Competition can now emerge rapidly from unexpected corners as barriers between sectors become blurred. In financial services, for example, a whole new batch of competitors has emerged from the technology side to challenge traditional financial institutions. Alibaba's Yu'ebao, a money market fund linked to its Internet payment accounts, is luring bank depositors away with much higher yields. In some cases, companies that emerge from the technology side may be more adept at mining data for insight and advantages than long-established industry leaders—which could opt to make a leap forward by acquiring or establishing a partnership with an attacker.

The Internet gives startups the ability to scale up rapidly and at low cost, unburdened by legacy systems and notions of "business as usual." Sales networks, which once took years to build, can be established virtually overnight. As a result, competition will intensify, and new winners are likely to emerge in a variety of industries. Larger incumbents, including state-owned enterprises, have to adjust to the challenges these competitors pose or risk being caught flat-footed. Business owners and CEOs will have to be deeply engaged as they undertake decisions that can radically affect how their companies do business. These transformations may entail technology and other types of investment that worsen the cost structure in the short term, but winners can reap the benefits for years to come.

Increased competition also means that companies need to develop differentiated offerings with the features consumers want. If they don't, consumers—who have newfound ability to compare offerings from multiple sellers with just a few clicks—will stand to capture most, if not all, of the value creation as companies compete solely on price.

Successful digital businesses continuously scout out new ideas and carefully manage their own product pipelines. They will also need to become adept at having a portfolio of options and institute a quick but rigorous process for bringing new initiatives to market. Adopting a mindset of continuous experimentation (for example, frequently testing to fine-tune the customer experience) is critical, but teams must quickly zero in on the digital investments that create the most value.[206]

## TRANSFORMING OPERATIONS

The Internet is forcing companies across all industries to rethink their operations, abandon old ways of doing business, and become more agile. Above all, businesses have to approach their digital transformations with high aspirations and a clear strategy in place. Today's fast-moving marketplace leaves little room for haphazard experimentation or uncoordinated digital initiatives. Companies will need to focus not only on the customer-facing side, but also on integrating Internet technologies into back-office functions and logistics, where they can lead to operational efficiencies and cost savings. Companies need to think through what they want to achieve with technology adoption and design holistic strategies that take into account leadership, talent, mindset, culture, process, and organizational structure. CIOs in particular may need to have a greater voice in designing strategy.

Undertaking a digital transformation may call for a complete end-to-end overhaul of existing processes, all of which support an exceptional and streamlined customer experience, most likely to be delivered with a combination of online and offline channels. Assembling a tightly integrated team with some members representing key business operations, others charged with implementation, and IT specialists who will actually build the technology can achieve fast and effective results.

Incorporating the use of big data can be a daunting proposition, but doing so can lead to better decision making and allocation of resources as well as customer insights. The effective use of big data also requires a mindset of continuous experimentation and the addition of talent that can design experiments, analyze large amounts of increasingly diverse data, and create compelling visualizations and stories to help decision makers use the results effectively.

Given the rapid growth of e-commerce, companies need to develop robust, multi-channel operating models. The pricing transparency created by the Internet increases pressure on the bottom line, making it vital for companies to be as lean as possible. It also opens the door to pricing conflicts between online and offline channels. It is not uncommon to find a price gap of 5 to 30 percent on the same item depending on whether it is sold online or in a physical store. This can be a source of confusion and dissatisfaction for consumers as well as offline dealers, who worry that their sales are being cannibalized. With more than 400 million 3G users in China in 2014, this phenomenon will only become more prevalent as consumers can use their smartphones to check prices while browsing in physical stores. If customers see an enticing deal online but cannot get the same merchandise, price, and experience in a physical store, they may be dissatisfied. Companies can build systems to manage this problem by, for

206 Tunde Olanrewaju, Kate Smaje, and Paul Willmott, "The seven habits of highly effective digital enterprises," *McKinsey Quarterly*, May 2014.

instance, separating online and offline SKUs (stock keeping units) to avoid direct comparisons, monitoring online pricing with clear consequences for dealers who violate guidelines, and aligning key performance indicators for offline and online channels so that sales teams and dealerships are not undermined. Creating a seamless online-to-offline experience is crucial to the customer as well as to the efficiency of the broader operation.

## ACQUIRING THE RIGHT CAPABILITIES AND DETERMINING THE RIGHT ORGANIZATIONAL STRUCTURE

As more and more companies adopt Internet technologies, they will face increasing talent shortages, particularly for highly specialized roles utilizing big data and advanced analytics. Workers who can combine knowledge of the pertinent sector with top-notch technology skills will be in high demand. In finance, for example, companies entering the sector from the technology side need employees who know how to assess credit risks, while established financial institutions will need to begin hiring high-tech talent. Industries that have traditionally been labor-intensive will begin to add more knowledge workers. When forced to choose, however, it may make sense to opt for candidates with skills rather than industry experience.

In addition to making outside hires, companies may need to develop their own talent pipelines. This could involve industry collaboration, partnerships with education providers, or public-private efforts to design targeted training programs to cultivate the skills that companies need—and such partnerships would allow companies to share the costs of workforce development. A focus on retraining existing workers rather than replacing them would avoid the need to recruit and develop new employees—not to mention the far more serious social costs of layoffs.

Companies may acquire specialized high-tech talent by hiring individuals, but larger firms may make targeted tech acquisitions to jumpstart their digital transformations. The next step is to carefully consider how to integrate these roles into their existing operations. Some companies "ring-fence" their technology teams since digital talent often has a very different working style. Wal-Mart, for example, established @WalmartLabs, an "idea incubator," in 2011 as part of its growing e-commerce division in Silicon Valley—and it intentionally kept this operation far removed from the company's Bentonville, Arkansas, headquarters so it could retain its edge. The group's innovations, including a unified company-wide e-commerce platform, helped Wal-Mart increase online revenue by 30 percent in 2013, outpacing Amazon's rate of growth. This approach will not work for every large incumbent, however, and even when it does, it may be only one step in the transition to more seamless internal integration of digital technology.[207]

207 Ibid.

Individual employees will have to adapt to using Internet technology, but there may be initial hesitation—especially as they may see technology as a threat to their roles. Change will not happen on its own. In some successful cases, CEOs or other top executives have assumed the role of "digital champion" to personally drive change across every corner of the company.

## BECOMING MORE OPEN TO PARTNERSHIPS AND OUTSIDE COLLABORATION

Technology is increasingly challenging the old business model of keeping major value chain activities such as product development fully in-house and under strict control. In the software industry, for example, a broader collaborative ecosystem of developers, plug-ins, software-development kits and application-programming interfaces, and add-ons creates added value and increases the "stickiness" of products. Similarly, companies in other industries need to think expansively about upstream suppliers as well as downstream vendors and consumers, focusing on how each part of the value chain integrates into the new platform.[208] Successful e-tailing marketplaces provide logistics, marketing, or payment services to support e-merchants, for example, while Google and Apple both offer support to the developer community to increase the number and quality of apps offered on their platforms. Travel portals allow users to assemble entire trips, bringing together offerings from airlines, hotels, car rental companies, and insurance providers.

To fully develop the ecosystem's value, competitors may collaborate in an effort to set consistent standards and build the broader market. AT&T, Cisco, General Electric, IBM, and Intel, for example, formed the Industrial Internet Consortium in March 2014 with an eye toward establishing standards for the Internet of Things.

For an ecosystem to succeed, its economics need to be structured in a way that defines a clear and sustainable revenue stream for all of the participants and aligns their incentives. For instance, telemedicine helps patients access high-quality medical resources at low cost, but the initial investment is too high for most individual patients to bear. Leading hospitals might also have limited incentives to offer telemedicine services since they already face excessive demand in the offline world. Whoever manages to build this ecosystem will need to find a way to make it financially attractive for the participating care providers.

Continuous quality monitoring is critical when multiple stakeholders are involved. The online medical consultancy platform Haodaifu, for example, constantly checks the accuracy of the information that participants post. E-commerce marketplaces have to ensure that their e-merchants are providing positive consumer experiences.

208 Hugo Sarrazin and Johnson Sikes, "Competing in a digital world: Four lessons from the software industry," *McKinsey on Business Technology*, number 28, winter 2012.

## Individuals will have to actively manage their own privacy and information and continuously upgrade their skills

Individuals are already reaping huge benefits from the Internet revolution: the power to comparison shop, a wider selection of goods and services, greater convenience, and instant access to information and entertainment.

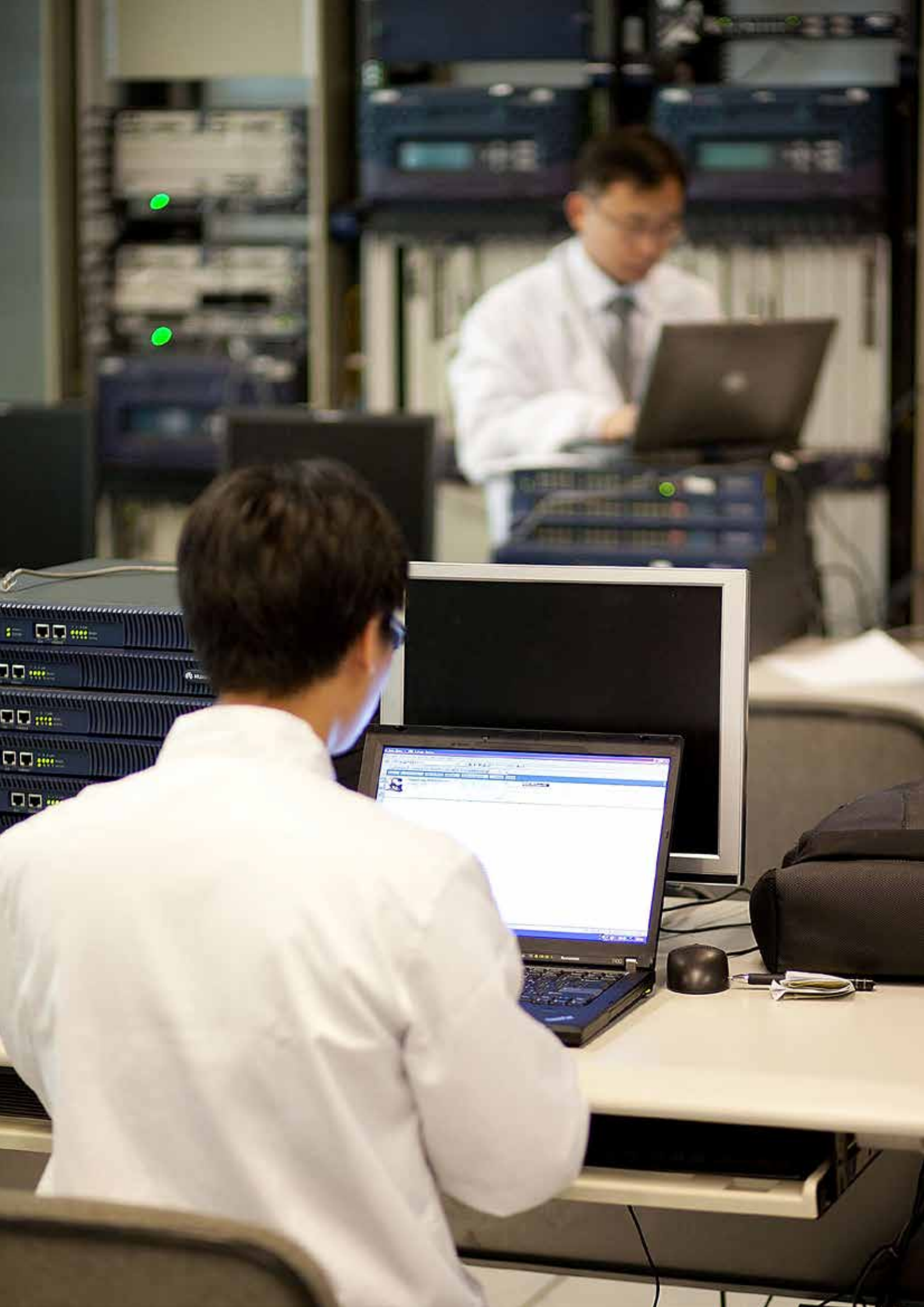
But they also face new risks. As consumers, they must be savvy and cautious about actively managing their privacy preferences, establishing their own comfort level with how much personal data to give away in order to obtain benefits. They need a greater awareness of the choices companies provide—and expressing their preferences now, when the Internet ecosystem is still taking shape in China, can influence how markets function in the years ahead. When a company doesn't offer adequate protections, individuals may need to switch providers. Not all Internet users will have the energy and expertise to navigate these choices, so advocacy groups could play a very important role in establishing standards for consumer protections.

Individuals will also face a much more challenging employment landscape in a more digital economy. The market increasingly requires new skills, and skill sets can become outdated much more quickly than ever before. Workers are less likely to stay in the same job or even at the same company throughout their career. They will need to keep abreast of where the employment market is moving, and they must continually refresh their skills to keep up. The success or failure of individual companies will ride in large part on the willingness of their existing employees to learn new skills, accept new roles, and adapt to the pace and the demands of a more digital marketplace.

However, individuals now have greater opportunities than ever before to become entrepreneurs, whether on their own or by joining e-commerce platforms. The Internet has dramatically lowered the costs of setting up a business and other barriers to entry. Abundant opportunities exist to fill new market niches—and the creativity and ingenuity of China's new Internet entrepreneurs will provide additional fuel for the economy to grow.

□ □ □

The Internet has already altered the way hundreds of millions of Chinese communicate, shop, travel, and experience entertainment. Now the next chapter of China's digital transformation is beginning to unfold as the Internet becomes more enterprise-driven. As companies embrace Web technology, they realize operational efficiencies—and when these efficiencies reach critical mass across an industry, they translate into productivity gains. Enormous new markets are being created as the Internet provides a platform for novel product and service offerings. The shifts that are still to come may entail some risks and disruptions, but they can ultimately support China's goal of creating a new and sustainable model for economic growth that will continue to raise productivity and living standards.



# Appendix: Technical notes

1. Sizing the "Internet Economy" with the iGDP indicator

2. Measuring the Internet's potential impact on GDP

3. Measuring the Internet's potential impact on employment

## 1. SIZING THE "INTERNET ECONOMY" WITH THE iGDP INDICATOR

The McKinsey Global Institute developed the concept of "iGDP" as a quantitative measurement of the Internet's impact within a given economy. The concept was created for a 2011 study that compared relative levels of "Internet maturity" in 13 countries and analyzed the Internet's potential for spurring economic growth.[209] This report updates the iGDP indicator for the same 13 countries to indicate how the Internet economy has grown around the world from 2010 to 2013 and how China's relative standing has changed.

Although there are three different methods for calculating the contribution a sector makes to GDP, none explicitly takes into account the total value contributed by the Internet to the overall economy of a country or a society. The production method measures the value companies add by producing goods and services; the revenue method measures the gross revenue of institutional sectors, including employee pay; and the expenditure method measures the total spending by consumers and government on goods and services.

The contribution of a sector to GDP is usually measured by calculating production. However, to quantify the Internet's contribution using this method, we would have had to obtain data on the proportion of revenue attributable to the Internet with associated margins for all companies in all sectors. Such an approach would have required too many unreliable estimates.

We therefore decided to use the expenditure method to calculate iGDP. This method looks at four factors: private consumption, public expenditure, private investment, and trade balance. Within each of these areas, we included all categories of goods and services enabled by the Internet and attributed an underlying portion of the value to the Internet. These are listed below, with footnotes indicating the data sources used for each category across the 13 countries examined.

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209 *Internet matters: The Net's sweeping impact on growth, jobs, and prosperity*, McKinsey Global Institute, May 2011. The 13 countries measured were Brazil, Canada, China, France, Germany, India, Italy, Japan, Russia, South Korea, Sweden, the United Kingdom, and the United States.

- **Private consumption.** This is the total consumption of goods and services by consumers via the Internet or needed to obtain Internet access, including electronic equipment, e-commerce, broadband turnover of telecom operators on the retail market, mobile Internet market, hardware and software consumption, and smartphone consumption.[210]

- **Public expenditure.** This includes Internet-related spending for consumption and investment by the government (software, hardware, services, and telecoms) at pro rata of Internet (described below).[211]

- **Private investment.** This is private-sector investment in Internet-related technologies (telecoms, extranet, intranet, websites, and so forth).[212]

- **Trade balance.** This includes exports of goods, services, and Internet equipment, plus B2C and B2B e-commerce, minus all associated imports.[213] We estimated B2B e-commerce based on numbers provided by academic studies, the overall size of e-commerce, each country's Internet maturity, and its offline trade balance.[214] We estimated the B2C overall trade balance based on academic studies as well as on each country's Internet maturity and size of e-commerce.[215]

For each component that contributes to iGDP, we then looked at the assumptions regarding the underlying portion related to the Internet:

- For electronic equipment (computers and smartphones), we applied a ratio based on the overall time spent on the Internet against the total time using the product.

- For goods and services sold on the Internet, we recognized them at their full e-commerce value because they indicate the importance of the Internet as a link in the distribution chain, even though certain online transactions might have occurred in the absence of the Internet.

- For Internet mobile and fixed subscriptions, we took 100 percent of individual expenses.

- For investment and trade balance in ICT goods and services, we used a bottom-up analysis based on the description of each subcategory

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210 For e-commerce (retail): *Online retail forecast*, Forrester Research, 2013; Euromonitor from trade sources/national statistics, 2013; and euromarketer database, 2013. For e-commerce (travel): *Online travel overview*, PhoCusWright, 2013. For e-commerce (gambling): *Online gambling*, H2 Gambling Capital, 2013. For broadband private revenue: Pyramid research. For mobile data: *Strategy analytics*, GlobalMediaForecast, 2013. For PCs: *Worldwide quarterly PC tracker*, IDC, 2013. For smartphones: Yankee 2013; IDC 2013.

211 *IT spending by industry market worldwide, 2009–2013*, Gartner, 2013.

212 Organisation for Economic Co-operation and Development StatExtracts data, projected using *IT spending by industry market worldwide, 2009-2013*, Gartner 2013.

213 ITC Trade Map, United Nations Conference on Trade and Development (UNCTAD) statistics, and e-commerce sources.

214 For example, *Evaluer l'impact du développement d'Internet sur les finances de l'Etat*, study on the behalf of the French Senate, October 2009.

215 For example, *Consumer attitudes towards cross-border trade and consumer protection*, European Commission Flash Eurobarometer, September 2010; *Retailers' attitudes towards cross-border trade and consumer protection*, European Commission Flash Eurobarometer, October 2010.

(software, hardware, services, and telecoms) made by the McKinsey TMT (Telecommunications, Media, and High Tech) database. This allowed us to allocate the share of these categories that could be directly linked to the Internet (e.g., 70 percent for software and services, 40 percent for hardware and telecoms).

All exchange rates used were taken from the StatExtracts database of the Organisation for Economic Co-operation and Development.

## 2. MEASURING THE INTERNET'S POTENTIAL IMPACT ON GDP

To measure the Internet's potential impact on sector GDP and employment in China, we need to define a future state. We chose to examine the year 2025, which allows a sufficient amount of time for Internet adoption to increase and take effect and for which reliable GDP forecasts are available.

To measure the Internet's potential impact on sector GDP, we interviewed more than 130 industry experts, from both outside companies and McKinsey & Company practices. Based on their input, we then followed the steps outlined below to arrive at an estimate.

- **Identify the Internet-related levers with the greatest potential impact on GDP and employment.** This list was developed for each sector based on the applications available today. (We acknowledge that there may be additional applications in the future, including some that could blur current industry boundaries.) We also focused on the main applications that are likely to see significantly wider adoption in the years ahead rather than applications like email that have already achieved substantial penetration. Once the levers were identified, we separated them into two categories:

  — Productivity gains: Levers for improving the efficiency of existing activities and reducing the resources required to conduct them

  — New market creation: New Internet-enabled product and service offerings that could generate additional sales and thus additional value add

- **Estimate the future adoption of these levers and their associated impact in 2025.** We estimated a range of potential adoption outcomes using the methodology described in Exhibit A1. The low end of the range represents the current trajectory, reflecting the current pace of adoption and the continuation of the constraints that exist today. The high end represents faster and more widespread adoption, which could be achieved if government, companies, and workers put all the necessary prerequisites in place to realize the Internet's full development.

  — For productivity gains: For each application, we estimate the share of industry costs that would be affected (e.g., marketing costs that could be affected by the adoption of online marketing tools and strategies), the 2025 adoption rate of this application (e.g., the percentage of advertising that will move online), and the share of costs that would be saved by adopting this application (e.g., the improved effectiveness of reaching a more targeted set of customers through online marketing compared with traditional channels). We then apply these three percentages to the projected size of

the industry in 2025, which is extrapolated based on the 2013 industry size and the real 2013–25 GDP growth rate that IHS projects for the sector. The full amount of the resulting productivity gain is considered a potential GDP increase, as we assume that any savings from productivity gains could be put into at least equally productive alternative uses in the economy (although the parties that ultimately benefit from these savings might not be companies within the sector).

— For market creation: For each application, we estimate the 2025 penetration rate and value add (EBITDA and employee compensation) as a percentage of sales. We also estimate the share of incremental sales out of the total new market—that is, we consider only the net incremental sales, after adjusting for any cannibalization of existing markets within the sector and its adjacent industries. For instance, e-tailing increases demand for modern warehousing but decreases demand for retail space, affecting both the real estate and construction sectors. We then apply these three percentages to the projected size of the market in 2025, which is extrapolated based on 2013 market size and the real 2013–25 GDP growth rate that IHS projects for the sector.

**Exhibit A1**

**We estimate the Internet's impact based on each lever's potential for future adoption and value creation**

Key MGI assumptions with low-high scenarios
Primary sources
Productivity gain incremental impact
Industry size, 2013
Industry and government databases (such as IHS and China Statistical Yearbooks)
Industry growth rate, 2013–25
IHS GDP forecast by industry, supplemented by other sources and expert views
% of cost affected
MGI analysis of industry databases, academic papers, analyst and company reports, and expert interviews
Adoption rate by 2025
MGI analysis of industry and academic research and expert interviews
Cost-saving ratio of relevant technology
MGI analysis of case examples, benchmarks, and expert interviews
New market creation impact
Industry size, 2013
Industry and government databases (such as IHS and China Statistical Yearbooks)
Industry growth rate, 2013–25
IHS GDP forecast by industry, supplemented by other sources and expert views
Penetration rate by 2025
MGI analysis of industry databases, academic papers, analyst and company reports, and expert interviews
Ratio of incremental growth (not including offline cannibalization)
MGI analysis of industry and academic research and expert interviews
Value creation ratio of incremental sales
MGI analysis of industry data

SOURCE: McKinsey Global Institute analysis

- **Estimate the impact of the Internet in 2013.** Following the approaches outlined above, we apply 2013 adoption and penetration rates to estimate the impact that has already been realized.

- **Derive the potential GDP impact.** We do so by subtracting the impact already realized in 2013 from the potential impact in 2025.

- **Normalize GDP impact by sector size.** We divide the potential GDP impact derived above by the sector GDP increase that IHS projects from 2013 to 2025.

For the financial sector, we also assume that Internet players and traditional financial institutions will bear the same risks by 2025. We do not discount the GDP impacts with additional risks, and we assume that Internet players will have to be governed by the same regulatory framework as traditional financial services firms for the sector to continue the rapid development of new Internet-enabled financial services and products.

The health-care sector is treated slightly differently than the other five sectors analyzed in this report. Rather than estimating the impact on GDP, we estimate savings on health-care expenditures. The GDP of the health-care sector, like that of other public or quasi-public sectors, is usually measured by inputs into the sector rather than the value add of the GDP. Any productivity-driven cost savings in the sector, however beneficial, could decrease the sector's GDP (although it could increase GDP in other sectors), assuming other things being equal. The health-care sector is excluded from calculations of the Internet's impact on overall GDP, as the results could be misleading.

It is important to note that the GDP increase due to Internet usage by a specific sector might not stay within the sector itself. The industry structure and strategies of individual companies will determine how much value will stay within the sector and how much will flow to other market participants (such as direct and indirect customers, suppliers, or even substitute or complementary industries). However, the value creation is real and will be realized somewhere in the economy. For example, as some industries move toward e-commerce sales, the increased transparency, competition, and efficiency may force them to lower the prices of their products. Consumers are the beneficiaries in this case, and they can then use the savings to purchase additional products and services within the same sector or in a different sector. However, we estimate only the resulting efficiency gain, which will translate into a GDP increase, but not the value shift from sellers to buyers due to this effect. We take a macroeconomic view, quantifying the value creation throughout the economy instead of attempting to predict winners and losers.

### Additional economy-wide effects

#### *Capital reallocation*

On top of the impact within the six sectors, there is a spillover effect due to capital reallocation. The financial sector can now use big data analytics and online channels to better analyze credit risk and bring down transaction costs; this creates both the necessary capabilities and right economics to increase access to credit for SMEs.

We estimate this impact by calculating the difference in returns on assets between large corporations and SMEs. First, we assume that China's total pool of available capital (loans, equity, and bonds) will grow at a certain pace from 2013 to 2025, based on IHS and analysis from experts in McKinsey & Company's Financial Services Practice. Second, we estimate that that share of capital directed to SMEs will become higher as Internet technology enables financial institutions to better serve smaller enterprises at lower cost. Third, we apply the return on assets difference between SMEs and large companies to the capital

that we estimate will flow to SMEs due to the impact of the Internet (as SMEs tend to be more capital-starved and have produced returns on assets in China). The return is defined as earnings plus employee compensation. This is applied after adjusting for the interest rate differential between large corporations and SMEs.

Because the Internet provides the financial sector with greater information transparency, lenders and investors would not only reallocate capital from the large corporate sector to the SME sector but they would also be better positioned to identify the most efficient companies *within* those two sectors. Although we did not assess this impact, it is also an important dynamic. As a result, our estimates for the impact of capital reallocation are likely to be conservative.

In the meantime, any impact on the value add of financial institutions is counted in the sector GDP contribution mentioned above.

*Incremental consumption due to online spending*

We conducted a regression analysis on offline spending, with two independent variables: online spending and disposable income. All variables are on a per household basis. A sample of 266 cities was selected given the availability of data. These cities represent more than 50 percent of GDP and 70 to 80 percent of online spending in China. The online spending data are from a major multi-category e-tailing marketplace, and they are combined with data from McKinsey's proprietary Insights China database. However, it is important to caution that the data do not cover the full market, and hence the results are an approximation, although they do capture the fundamental trends at work.

We used 2012 and 2013 data, the latest available (online data are actual, while some offline data are estimates). We ran three variations of the regression: 2012 data, 2013 data, and 2012 plus 2013 data. All there combinations yield reasonable results. The coefficient of online spending per household (X1) is -0.89 in 2012, -0.96 in 2013, and -0.90 in 2012/2013 data. That is, every dollar of online spending reduces 0.9 dollars of offline spending, leading to a net increase of 0.1 dollars of total consumption. The coefficient of disposable income per household is 0.53–0.54 for the three variations, in line with the 40 percent household savings rate and the positive intercept.

The results based on 2012/2013 data show that online spending brings positive incremental consumption. This confirms what we found based on 2010/2011 data.[216]

In addition, the 2SLS approach is used to address the interdependency between total spending and online spending. The first step is to perform a regression on online spending, with the following instrumental variables: tertiary education, age, and broadband penetration. The selection of the instrumental variables is mainly limited to city-level data availability. The second step is then to perform a regression on total spending, with two independent variables: estimated online spending and actual disposable income. The coefficient for online is also positive for different combinations of 2012 and 2013 data, confirming that online spending does generate incremental consumption, instead of just substituting offline spending.

216 *China's etail revolution: Online shopping as a catalyst for growth*, McKinsey Global Institute, March 2013.

### Extrapolating from sector impact to economy-wide impact

The sectors we examined account for about one-quarter of China's GDP in 2013. We estimated the impact on the entire economy by extrapolating from the bottom-up analyses in the six sectors to the remaining ten sectors by assuming same degree of Internet impact within industrial and service sectors, respectively.

## 3. MEASURING THE INTERNET'S POTENTIAL IMPACT ON EMPLOYMENT

The sector GDP impact is used to estimate the employment impact associated with each lever. The numbers are estimated from a 2013 baseline and then extrapolated to 2025 using a sector employment growth rate. The sector employment growth rate is estimated by multiplying the growth rate of China's labor force by the sector GDP growth rate and then dividing by China's projected GDP growth rate between 2013 and 2025.

- For productivity gains: The potential GDP increases due to labor savings translate into reduced employment. In estimating this impact, we consider only the GDP increase due to labor savings, which, divided by the average cost per worker, results in a lower employment number.

- For new market creation: The potential GDP increases due to value add generated by new Internet-enabled markets translate into an increase in employment opportunities. This number, divided by the estimated value add per worker, results in a higher employment number.

Capital reallocation to SMEs could also have a positive impact on employment. The GDP contribution from capital reallocation is the net increase of value add for the funds reallocated from large companies to SMEs. Based on the latest available data from China's National Bureau of Statistics, the productivity of small companies is about 70 percent of the level of large enterprises. We assume that the capital will flow into the most efficient SMEs (those with productivity matching the average level of large enterprises). The employment impact is derived by dividing the net GDP increase by the assumed labor productivity.

Finally, incremental consumption could generate some additional employment. China's retail sales will continue to move online, and 10 to 39 percent of them could generate incremental consumption (see the discussion above). This additional consumption could generate additional employment opportunities, although it is unclear how much of this overlaps with the employment impact associated with specific market creation levers estimated with the approach discussed above. As a result, this lever has greatest level of uncertainty and could potentially have negligible incremental impact.

The employment impact is assessed on top of the 2025 estimated employment numbers (assuming a future employment rate similar to today's level, on a World Bank projection for the future size of the labor force). Any baseline change is therefore excluded from the Internet's impact.

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